THE EFFECT OF RETRIEVAL ORIENTATION INFORMATION ON THE KEYWORD METHOD IN IMMEDIATE AND DELAYED RETENTION

BY

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The purpose of this study was to determine the effect of retrieval orientation information presented at the time of encoding on group administered subjects. Three groups in all were tested: keyword encoding subjects (KE), keyword encoding plus retrieval orientation information subjects (KER), and free choice controls (FCC). The sample population comprised 110 volunteer subjects (41 males, 69 females) from which the three groups were randomly selected. The experimental task, using group administered procedures, was to learn the definitions of 31 uncommon English words, previously used by another keyword experimenter, given 45 seconds of study time per word and definition. Identical imagery suggestions were provided for both KE and KER subjects by the experimenter. Upon completion of the task, a test of immediate recall was administered. This was followed, 1 week later, by a test of delayed retention

In the test of immediate recall, the KER group scores were significantly higher than the FCC group scores ($p < .05$). Furthermore, discounting those subjects who failed to return 1 week later for delayed retention testing, the KER group scores were statistically higher than those of the KE group.

In a test of delayed retention, administered 1 week later, KER subject scores were significantly higher than both KE and FCC subject scores ($p < .05$).

Support for the retrieval failure theory, as outlined in the information processing memory model, was thereby obtained in this study. It was concluded that retrieval orientation information, presented at the time of encoding, can help to produce significant group administered recall scores for keyword subjects.

CHAPTER I
INTRODUCTION

Mnemonic [illegible] [illegible] [illegible] used since ancient Greek times to supplement and [illegible] the powers of human memory (Yates, 19[illegible]). [illegible] the attempt to understand empirically the [illegible] [illegible] of these techniques has only been undertaken within the last few decades (Higbee, 1976b). Although the foundation of mnemonic knowledge remain unfinished, a considerable body of literature regarding definitions and classifications of mnemonic strategies has been developed and much research has been conducted regarding questions of their usefulness, implementation, and effectiveness in educational settings.

One of the most widely used and widely investigated mnemonic techniques has been that of the keyword method. The keyword method involves the finding of a semantically related or phonetically related word that is a part of the larger vocabulary word to be learned. For example, the Spanish word pato means duck. A phonetically related English word which represents part of the Spanish word would be the word pot. After a keyword has been discovered, it is visualized and then connected to the English translation with interacting imagery. One could visualize a duck wearing a pot, a duck sitting in a pot, a duck holding a pot, or a pot that is shaped like a duck. It is important that the images be interacting in some manner (Bower, 1970). Later, when the student hears or sees the Spanish word pato, he or she will recall that pato sounds like pot and this will conjure up the image of a pot shaped like a duck. Thus the student will respond, "Pato means duck." With repeated exposure to the Spanish word it is assumed that the interacting image will drop out (Reed, 1918) and that the student will remember the word. Thus, the primary purpose for students' use of the keyword method is to save time (Higbee, 1976a). Used at the time of encoding, it would appear that the keyword method can help speed the process of initial learning, while making new learning appear less difficult and more interesting than simple rote repetition.

There is considerable experimental evidence that the keyword method is effective as a learning strategy with both children and adults (Bellezza, 1981; Higbee, 1976a; Levin, Pressley, McCormick, Miller, & Shriberg, 1979; Negin, 1978; Pressley, Levin, & McCormick, 1980; Pressley, Samuel, Hershey, Bishop, & Dickenson, 1981; Raugh & Atkinson, 1975). The majority of studies indicate that the keyword method, when used to teach students Russian, Spanish, English, French, and Latin vocabularies, has been successful in achieving significant learning gains. Preschool children have also been taught the keyword method using interacting pictures to facilitate encoding (Pressley, Levin, & McCormick, 1980). The keyword method has been investigated with preschool, elementary, junior high school, high school and college students in English vocabulary tasks, foreign vocabulary tasks, the learning of cities and their products, the learning of states and their capitals and in the study of spelling words. The majority of these studies have been concerned with the acquisition of foreign vocabularies.

An apparent lack of English keyword studies is evident in the professional literature. A search of the literature revealed only five keyword studies in which college students were used as subjects in tasks of English vocabulary acquisition. Four of those studies (Pressley & Levin, 1981; Pressley, Levin, Digdon, Bryant, McGivern, & Ray, 1982; Pressley, Levin, Kuiper, Bryant, & Michener, 1982; Pressley, Levin, & Miller, 1981) tested college students on an individual basis (one-to-one) and obtained favorable results, while the one English keyword study (McNeal, 1973) in which college students were tested in groups (intact classes) did not produce significant statistical results for keyword subjects. Pressley, Levin, and Miller (1981), who have consistently obtained significant statistical support for the keyword method when students were tested individually, were thereby prompted to write, ". . . the keyword method has yet to prove itself effective in classrooms with older children and adults. . ." (p. 2 1). In that same discussion, Pressley et al (1981) therefore concluded that ". . . more classroom assessments of the keyword method are needed, especially those involving high school and college students" (p. 224).

A recent study by Hall, Wilson, and Patterson (1981) compared group versus individual presentations with keyword subjects (college students) on English definitions of 30 Spanish words. This study discovered some significant limitations of the keyword method when subjects were asked to learn Spanish-English word pairs at their own pace. There were no differences in retention rates between free choice and keyword subjects under the free pace condition. Only when the experimenter presented each word and definition at a 10 second presentation rate did keyword superiority appear.

In direct response to the Hall et al. (1981) study, Pressley, Levin, Digdon, Bryant, McGivern, and Ray (1982) also paced college subjects at a 10 second rate using English vocabulary words and definitions in conjunction with the keyword method. While some subjects were paced, other subjects studied the same words and definitions, also via t keyword method, at their own study rate. When compared with free choice controls, both paced and unpaced keyword subjects scored significantly higher than controls. Later, when subjects were group tested (same study), controls outperformed keyword subjects. This led Pressley, Levin, Digdon, Bryant, McGivern, and Ray to conclude that group administration and not pacing was the variable responsible for the nonsignificant results.

None of the five English keyword studies nor the Hall et al. (1981) study examined the effect of a cognitive retrieval strategy upon recall. To date, no researcher has taken the step of orienting subjects for recall except for Singer (1977) who orally taught the keyword method to inner city junior high students for learning French vocabulary words and definitions. However, there was no control group provided for comparisons in that study, although Singer reported that as many as 98.6% of the 20 keyword-learned French words were recalled by her students.

Haley and Vondrell (1977) theorize that various mnemonic systems can be used to assist students in learning new information (i.e., encoding skills) that is to be later tested (recall phase). In addition to providing encoding information, the authors advocate the use of additional information subtitled, "How Will It Work on the Test?" (retrieval orientation). Although the inclusion of such retrieval information has remained empirically untested, they maintain that retrieval information can help students better recall new information.

In summary, the keyword method has been substantiated when empirically tested in comparison to free choice controls (Pressley & Levin, 1981, Pressley, Levin, Digdon, Bryant, McGivern, & Ray, 1982; Pressley, Levin, & Miller, 1981) and also when the method has been compared to other more traditional learning strategies advocated by language theorists (see Pressley, Levin, [illegible] 1982 for examples). However, when the method has been group administered to adults and high school students, there have been no significant differences obtained between keyword subjects and controls (Pressley, Levin, Digdon, Bryant, McGivern, & Ray, 1982). These researchers therefore concluded, "Perhaps investigators who would have devoted their energies to addressing the pacing-interaction 'limitation' [referring to Hall et al., 1981] might more profitably redirect their efforts to finding a solution to the group-administration difficulties that are apparent in the findings of Levin et al. (1979), Hall et al. (1981), and Experiments 2a and 2b reported here" (pp 21-22). Therefore if a retrieval technique could help provide significant statistical differences between keyword subjects and controls, when group administered, the suggestion of Pressley et al (mentioned above) and, thereby, a solution to the group administration problem, may be provided.

Bellezza (1981) noted, "If subjects are to use mnemonic devices successfully, then they should have adequate training on each component of the mnemonic that is necessary for its successful use" (p. 266). Although Bellezza (1981) does not specifically define what is meant by "adequate training on each component," one interpretation may be that "adequate training" consists, in part, of retrieval orientation information, the kind of information that is repeatedly presented in Haley and Vondrell's (1977) mnemonic test study book.

Purpose of the Study

It was the purpose of this study to determine if additional keyword information (i.e., information that helps to orient subjects for recall) can help produce significant keyword group administration results. Three groups in all were tested. Keyword subjects who were provided with encoding information only (KE); keyword subjects who were given this same kind of encoding information plus retrieval orientation information (KER); and free choice control subjects (FCC). Both keyword groups received identical experimenter-imposed imagery suggestions (Appendix I).

A presentation rate of 45 seconds per word was selected as a compromise between presenting subjects with all words and definitions at once (Hall et al., 1981) and presenting subjects with 10 second paced words (which Pressley and his associates typically chose). As will be noted further in Chapters III and IV, three pilot studies were conducted to help determine this 45 second time variable.

Since there is no reason to believe that English words and definitions would produce any different results from Spanish-English word pairs used by Hall et al. (1981), the present study did not investigate the relationship between individual versus group testing procedures on the single variable of time. Instead, an investigation of retrieval orientation information versus traditional keyword presentation (encoding information only) was the primary variable of investigation in the present study within a group context.

The question of long term retention. A question related to the effect of retrieval orientation information is that of retention length. In an extensive review on mnemonic devices, Bellezza (1981) [illegible] "[illegible] studies indicate that information becomes inaccessible over time at the same rate regardless of the way it was learned" (p. 267). Likewise, Hall et al. (1981) discovered no significant differences between keyword and controls at the end of 1 week. However, since Bellezza was referring to research that involved subjects learning encoding mnemonic strategies only (i.e., without any additional retrieval orientation information), the important question remains as to whether subjects who are given additional retrieval orientation information would remember a recall task 1 week later.

For the purposes of the present study, long term retention was defined as any period longer than 24 hours after initial learning had taken place. This definition was taken from Luiten, Ames, and Ackerson (1980) who conducted a meta-analysis on the effects of advance organizers on learning and retention. In that study a period of 24 hours or less was defined as the learning phase, while tests of recall that occurred more than 24 hours after initial learning were simply titled "retention."

Rationale

Since the present study focused on retrieval as well as encoding strategies, a brief presentation of the information processing theory relevant to these two topics will now be briefly presented.

Several models of memory have been postulated over the past two decades, many of which outline a three part or three phase memory system. For purposes of the present experiment, Atkinson and Shiffrin's (1977) memory model provides the central theoretical base. In that model, as illustrated in part in the diagram below, information enters the human mind via one of the five senses. In other words, all information that is eventually stored in long term memory is initially perceived or experienced by the human organism through either taste, smell, touch, hearing, or seeing.

(Conscious Memory)
SENSORY STORE ⟶ SHORT TERM MEMORY ⟶ LONG TERM MEMORY
⟵
(Rehearsal Buffer)

From sensory storage, which has a duration of one or two seconds, information then enters short term storage where it is either maintained or elaborated, elaboration enables the information to then be transferred to long term memory. Short term memory is therefore seen as conscious awareness; if a person wishes to retrieve information from long term storage, he must bring that information back into conscious awareness, i.e., short term memory

In all three phases of memory there are components of encoding, storage, and retrieval of information. Therefore, it is postulated that forgetting can occur in any stage of memory encoding: failure to encode information sufficiently for either short term or long term memory can result in forgetting, while failure to absorb or learn appropriate retrieval techniques for either short term or long term memory can also be a cause for forgetting (Atkinson & Shiffrin, 1977).

Forgetting as a result of retrieval failure is a relatively new theory (Shiffrin, 1970). Behaviorists, who dominated psychological thought for nearly 50 years, theorized that forgetting occurs primarily due to interference (Loftus & Loftus, 1976). Two kinds of interference theories were postulated: proactive interference and retroactive interference in which (1) information that was learned prior to the new information (proactive) interferes with recall of the new information, and (2) information that was learned after the new information (retroactive) interferes with recall of the old, previously learned information.

In retrieval failure theory, forgetting is viewed as failure of one's memory search during retrieval. An experiment by Shiffrin (1970) clearly indicates support for this hypothesis. Lists of words, either five or 20 words in length, were read to subjects. Subjects were then asked to recall either the first or second list of words they heard. It would be hypothesized from interference theory that the longer the intervening list (i.e., the list not to be recalled), the fewer words the subject should be able to recall from the target list. But Shiffrin discovered that only the size of the list to be recalled affected recall performance. In fact, Shiffrin noted that a longer intervening list resulted in somewhat better recall. Shiffrin concluded that ". . . retrieval factors in forgetting are considerably more important than factors dependent on a degrading [sic] trace." Therefore, Shiffrin's retrieval failure theory is relevant to the understanding of the present study since it provides a rationale for the teaching of retrieval and encoding information to some subjects.

Significance of the Study

In the present study two experimental keyword conditions were under investigation with group administration procedures operating. One keyword group received keyword encoding instructions and experimenter-imposed keyword imagery suggestions, which is not only typical in a majority of keyword experiments but is also recommended by the researchers who originated and initially investigated the keyword method (Raugh & Atkinson, 1975). However, the second keyword group, besides being provided with encoding keyword strategies, was also given keyword retrieval orientation information. To date, no study has investigated the effect of retrieval orientation information on keyword subjects. Three experimental groups in all were tested: Keyword encoding plus retrieval information (KER); keyword with encoding informat[illegible] tal control group (ECG[illegible]) experimenter-imposed imagery.

Based on research evidence that has been cited in various literature reviews (Bellezza, 1981, Pressley, Levin, & Delaney, 1982; Higbee, 1976[illegible] Higbee, 1979) it is no longer a question of whether or not mnemonic systems are worth investigating, but how they can best be implemented in educational contexts. In a comprehensive literature review, in which four mnemonic systems were described and research evidence was provided, Kenneth Higbee (1976b) writes, "The conclusion suggested by the relevant research on these systems is that mnemonic systems can make enough of a contribution to memory to warrant mastering their use and continuing to conduct research on them. Mnemonic systems are worth the effort" (p. 17) (Higbee's emphasis).

It is now the task of educational psychologists to determine methods and techniques in which mnemonic systems can best be used in intact classrooms. As was mentioned previously, the primary purpose of any mnemonic system is seen in the decreased amount of initial learning time needed for learning new information. Since mnemonic subjects typically need less overall study time in initial learning, the current task of investigators is to determine how mnemonic strategies can best be taught in group contexts. Pressley, who has found significant and continuous statistical support for [illegible] individual presentations, r[illegible] approach for intact classrooms (Pressley, Levin, & Miller, 1981). If retrieval orientation [illegible] enables students in intact classrooms to recall more vocabulary definitions than controls (or encoding keyword subjects), then researchers can further investigate exactly which variables (i.e., time variables or retrieval information variables) contribute to the increased keyword retention effect.

Summary

Positive keyword results, when college students have been tested experimentally in groups, have not been obtained (Hall et al., 1981; McNeal, 1973). The investigation of college undergraduates in group learning and testing conditions was the focus of the present experiment. Some researchers have questioned why favorable group results have not been obtained (Levin et al., 1979; Pressley, Levin, Digdon, Bryant, McGivern, & Ray, 1982). In the present study it was proposed that since retrieval orientation has not been provided to subjects (who have been quickly exposed to the keyword method and provided with little practice), keyword encoded information may not be readily retrievable at the time of recall (testing). Pressley, Levin, and Miller (1981) have optimistically predicted, "Given the large volume of data indicating that the [keyword] method positively affects such mature learners when studying vocabulary on an individual basis [illegible] useful classroom application [illegible] If the keyword plus retrieval information [illegible] obtain higher recall scores in tests of [illegible] immediate and delayed recall, there will be further re[illegible] to support Shiffrin's (1970) retrieval failure [illegible] that is, in terms of the information processing model (Atkinson & Shiffrin, 1977), the retrieval cue consists of a keyword and an experimenter suggested imagery link, in the present experiment. Understanding how keywords help subjects at the time of recall (by providing this additional orientation information) may make a significant difference in group administered tests of immediate and delayed recall. Therefore, two hypotheses were tested in the present study:

Hypothesis I: There are no statistically significant differences in the number of vocabulary definitions recalled between group administered keyword encoding subjects, keyword encoding plus retrieval orientation information subjects, and free choice control subjects in a test of immediate recall.

Hypothesis II: In a delayed recall test of 1 week, there are no statistically significant differences in the recall scores of keyword encoding subjects, keyword encoding plus retrieval orientation information subjects, and free choice control subjects.

Chapter II presents a review of related literature along with definitions of [illegible]. Chapter III outlines the procedures used in the present study and Chapter IV details the results. The final chapter contains a summary, discussion, and recommendations for future research on the keyword method.

CHAPTER II
SURVEY OF LITERATURE

In the present study, the keyword encoding method was implemented among two groups, one of which received a strategy for word retrieval. A third group, operating under the free choice condition, was used for control. The group administration procedures used in this investigation, described more fully on page 56, refer to the distribution of identical, written materials to each member of a group, because there were three experimental groups, three different sets of instructions were used. Using group administration procedures, the high degree of variability inherent in individualized subject instruction is reduced. The effectiveness of these groups was evaluated during a test of immediate recall and again, 1 week later, during a test of delayed retention.

Of essence in the present study was the effectiveness of retrieval orientation information presented at the time of encoding. The keyword method has been viewed by researchers as primarily an encoding strategy (Bellezza, 1981) and, as such, has been considered a valuable time-saver when compared with traditional rote repetition learning strategies (Higbee, 1976b). However, despite this effectiveness as an encoding strategy, there have been few keyword experiments with adults

using group administration procedures ([illegible]
Delaney, 1982; Pressley, Levin, [illegible]

This review of literature will [illegible] six areas of research on mnemonic devices, with a [illegible] emphasis on the keyword method: (1) a definition of terms, an examination of how mnemonic systems are cognitively organized, and a historical perspective; (2) general mnemonic research; (3) literature on the effects of imposed versus induced imagery with mnemonic subjects (since the present experiment used imposed imagery); (4) a review of group administered keyword studies; (5) the effect of time factors on subject learning and recall; and (6) the effects of immediate versus delayed retention on mnemonic subjects.

Definition of Terms

"Mnemonic" is a term that originated during the times of the early Greeks. A person unable to recall something would summon the Greek goddess of memory, Mnemosyne. To date, Mnemosyne's name is rarely invoked, yet survives in the word "mnemonic," meaning "a clever device to better remember something."

Mnemonic Classifications

Bellezza (1981) identified two broad categories for mnemonic classification: Mnemonics that are used for organizational purposes and mnemonics that are used for encoding purposes. These two categories will be discussed in that order.

Organizatio[illegible] [illegible], these mnemonics are imple[illegible] [illegible] [illegible]r needs [illegible] better organize the infor[illegible] [illegible], such as speeches, prose material or [illegible] [illegible]. The method of loci is a well-known e[illegible] [illegible] [illegible]ory. This method is demonstrably effec[illegible] [illegible] [illegible] word lists (Ross & Lawrence, 1968). In the method of loci, a subject associates novel stimuli (e.g., words) with some familiar topological order, which could be, for example, the objects passed in walking through the subject's living room: a desk, bookcase, and television. These three objects are then visually paired with the new words, e.g., frog, translator, and trash, such that the subject might perhaps visualize a frog typing at the desk, a book about translators, and trash in or on the TV. When the subject subsequently recalls the objects in the living room, the new words should also come to mind in the order they were learned. Presently, however, there is no evidence that a particular mnemonic technique is superior to any other technique (Wood, 1967).

Encoding strategies. As identified by Bellezza (1981), encoding strategies include schemes for recalling long strings of numbers, as well as the encoding of abstract and concrete words. Paired-associate tasks and the keyword method are the best known in this category. In contrast to organizational mnemonics, encoding strategies associate novel stimuli to their definitions (in the case of words), through the use [illegible] keyword. The necessity, therefore, for maintaining [illegible] word order is no longer relevant.

There is an [illegible] category of variables that is often included in investigations of mnemonic strategies, namely, encoding factors. These encoding factors are used in both organizational mnemonics as well as encoding mnemonics. As identified by Higbee (1976b), there are five relevant encoding factors: Imagery (Bower, 1972); concreteness versus abstractness of images (Bugelski, 1974); induced versus imposed imagery (Bugelski, 1970), the importance of having interacting images (Bower, 1970); and time factors (Bugelski, 1968), which are discussed in more detail in a later section, as well as one irrelevant encoding factor bizarreness (Wood, 1967).

Imagery, which is synonymous with visualization, is essential in organizational mnemonics as well as encoding strategies. It has become a predominant field of interest in a short time, spawning a new professional publication, The Journal of Mental Imagery, which was first published in the spring of 1976. Imagery continues to be a source of interest for researchers in several diversified fields: Reading comprehension, writing processes, education of the gifted, and even in sources of healing (Ashen, 1981).

How Mnemonic Syste[illegible]

Reese (1977) has pro[illegible] the study of mnemonics as well [illegible] that single images are inheren[illegible] memo[illegible] lack permanence, and therefore tend to become assimilated by more general, superordinate categories. Mnemonics, he states, allow for the retrieval of images because two images, instead of one, become associated together and are generally combined in an interacting manner. Hence, the information to be remembered is able to be retrieved from cognitive storage at a later time, via a mnemonic strategy and the use of imagery. This theory has been supported by Shiffrin (1970) who concluded that forgetting is simply a matter of retrieval failure, rather than the result of interferences as traditional S-R theorists postulate (Keppel & Underwood, 1962; Briggs, 1[illegible]4).

Historical Perspective

The keyword method has been implemented successfully in a variety of learning situations, including foreign languages, English vocabulary, spelling, as well as the learning of cities and their by-products. Much of this experimental work occurred under individual administration of the keyword method. It was noted, in the definition of terms section, that the keyword method is one encoding scheme that has emerged as a mnemonic technique. Research on the keyword method [illegible] of other mnemonic research.

The following literature [illegible] over the past two decades. Mnemonics, [illegible] have outstanding results, especially when compared [illegible] on tests of recall between mnemonic and rote [illegible] subjects. Yet, rote repetition appears as one of [illegible] frequently used techniques, according to students surveyed about their memory skills and study habits (Poythress, Underwood, Weinstein, Schulte, & Morrow, 1980; Blick & Boltwood, 1972; Blick, Buonassissi, & Boltwood, 1972, Blick & Waite, 1971).

Researchers began testing the effectiveness of mnemonics by giving subjects long lists of words to memorize. Results favoring mnemonic subjects were obtained in a majority of the studies. Researchers in the early 1970's began searching for ways in which mnemonics could be introduced into the classroom to help improve reading comprehension, vocabulary knowledge, foreign language study, spelling, and other kinds of paired-associate learning tasks. Again, mnemonic subjects outperformed other subjects in most experimental tasks. The term "keyword method" was first used by Raugh and Atkinson (1975) in their research at Stanford University. They illustrated repeatedly that the keyword method was effective in teaching beginning language students foreign vocabulary. In later research, it was also discovered that given the choice, students readily requested keywords to supplement their foreign language learning [illegible] Shupbach, & Atkinson, 1977)

Other various applications of the keyword method were then investigated by a number of researchers (Engle, Nagle, & Dick, 1980 Levin, Shriberg, Miller, McCormick, & Levin, 1980, Megin, 1978, Watkins & Schadler, 1980). Numerous creative applications of the keyword technique were discovered and results were found favoring a 10 second presentation rate (Pressley, Levin, Digdon, Bryant, McGivern, & Ray, 1982) when subjects were tested individually. Four dissertations (Fuentes, 1976, Johnston, 1974; McNeal, 1973; Willerman, 1977) investigating the use of the keyword method with college or high school subjects did not produce significant statistical results favoring the keyword method under group administration. However, in at least one of these dissertations (McNeal, 1973), the keyword method was apparently misunderstood (see page 38 for an explanation). The resultant student misdirection may have affected the statistics.

Finally, the need for group administered keyword applications has been acknowledged: "Whether or not the keyword method can be implemented effectively in actual high school and college foreign language courses therefore looms as a priority area of investigation" (Pressley, Levin, & Delaney, 1982, p. 79). Requisite for foreign language instruction is first language (English) learning, which was the primary task of the present group administered experiment.

General Mnemonic [illegible]

The effectiveness of m[illegible] traditional rote repetition o[illegible] has been investigated to quantif[illegible] vement as well as to justify continued mnemonic [illegible]. This section cites experimental evidence s[illegible] use of mnemonic techniques for improving recall [illegible] comprehension, learning foreign and English vocabulary (keyword method), shorthand, plus the teaching of elementary students and the educable mentally retarded.

In a comprehensive study of recall based on five experimental conditions, Wood (1967) concluded that mnemonics usage significantly improves recall of word lists. Subjects were provided with six lists of 40 words each and recalled approximately 30 words or more per list when mnemonic techniques were employed

The applicability of using mnemonics to assist in readint comprehension was studied by Pressley (1976) Using 86 third graders, Pressley exposed them to increasingly lengthier prose passages There were 17 significant components to be recalled from a short story. Those children who were instructed to construct visual images for each component of the story recalled a significantly greater number of story components than controls who were instructed "do what you can to remember.' Research indicates that mnemonics could be taught to aid in reading comprehension (Wagner & Johnson, 1975; Koser & Natkin, 1972)

A succession of studies on the use of mnemonics for remembering foreign vocabularies (specifically Spanish and Russian) indicated that subjects learned foreign vocabularies quicker and retained them longer when employing the keyword method (Atkinson & Raugh, 1974; Raugh & Atkinson, 1974; Atkinson, 1975). In fact, when subjects, after being trained in mnemonic techniques, were given the option of requesting a mnemonic keyword or using their own devices, a majority of subjects requested the keyword method a significant amount of the time (Raugh & Atkinson, 1975).

Fifty-two college undergraduates at Stanford University were given Russian words and were required to associate them with English sound-alikes. These English keywords were then visualized by the subjects with the actual English translations in an interacting fashion. Keyword subjects scored 72% correctly, as compared to 46% for the no-keyword controls (Atkinson & Raugh, 1975).

Raugh, Schupbach, and Atkinson (1977) later tested the effectiveness of the keyword method with 13 second-year Russian language students. The researchers were uncertain about the impact of the keyword method with sophisticated language learners. However, using a computerized program with these students over a 10 week period, the results indicated that not only was the keyword method still deemed highly effective, but when students were left to their own choices, they most often elected to use the keyword method on a frequent basis.

Sprenger (1[illegible]) used mnemonic techniques to facilitate beginning secretarial majors in learning basic shorthand symbols. Statistical support indicated that the mnemonic group took fewer trials to reach criterion and also retained those symbols better

Watkins and Schadler (1980) investigated the effects of mnemonic training for assisting 90 first and third grade children to remember the spatial arrangement of nine zoo animals. After initial training in a version of the loci method, the experimental group was required to replicate the placement of the nine animals as they recalled seeing their placement in the model zoo. The mnemonic technique involved instructing the children to place the animals one at a time, in a chaining fashion, by using one animal as the starting or beginning point of the chain These directions reduced placement times for all groups

Mnemonic techniques have also been used with positive results in the training of the mentally retarded (Engle et al., 1980). Semantic training was given to approximately half of 51 11- and 12-year old EMRS (educable mentally retarded) who were taught category organization for word lists in one of eight experimental conditions The words, either related or unrelated, were better remembered in both immediate and delayed recall tasks by the groups that received the semantic training.

The keyword method was co[illegible] other methods of vocabulary learning in five [illegible] Pressley, Levin, Kuiper, Bryant, & Michener 1[illegible] [illegible] first experiment, 30 low frequency English nouns [illegible] [illegible]nitions, typed on individual cards, were shown to [illegible] undergraduate subjects. All students were individually paced at a 10 second rate. There were six learning conditions, two of which were the keyword method. One keyword group was instructed to visualize while the other keyword group was instructed to form interactions between words and definitions through sentence use only. A third experimental group was instructed to visualize the definitions but not the corresponding vocabulary words. A fourth group was told to think of synonyms to help them remember the vocabulary words and definitions. Two other groups consisted of (1) read and copy instructions (i.e., write down each word and definition one time each), and (2) a free choice control group. In a test of immediate recall, both keyword groups (imagery and sentence) obtained mean scores significantly higher than students in any of the other four groups.

In experiment 2, two other language learning strategies, recently supported in educational literature (Rogers, Kuiper, & Kirker, 1977), were compared with keyword imagery, definition only imagery, and free choice controls. The two "literature supported" groups were instructed to use variations of the traditional keyword method in conjunction with self-referent or familiar referent images.

Thirty words [illegible] 1, were individually paced at [illegible] per word for [illegible] undergraduates. Pressley et al. [illegible] that the traditional keyword subjects and those instructed to visualize something "personally meaningful to them (i.e., familiar referent group) obtained the highest score, but the keyword subjects instructed to visualize themselves (self-referent) along with the keyword and definition scored no higher than the other two experimental groups (free choice controls, definition imagery). The claim of Rogers et al. (1977) that self-referent processing produces greater recall was not supported by Pressley et al. when the technique was used in conjunction with the keyword method. Pressley et al. explain this negative finding by suggesting that keyword imagery plus additional self-reference complicates the keyword process, thus producing the lowered mean score. However, considering that keyword self-referent subjects were paced at 10 seconds, it could be that these subjects simply did not have enough time to process the additional imagery requirement. Reaction time for processing three images would certainly be greater than reaction time for two images. On the other hand, traditional keyword subjects and subjects instructed to image something familiar to them (self-referent) both had only two images to contend with: Plausible or bizarre. Since previously cited studies indicated that it makes little difference whether images are plausible or bizarre so long as the images are interacting (Bugelski, 1970), there was little difference between the traditional keyword group and the familiar-referent keyword group except that one group was instructed to visualize plausible images only (familiar referent). An additional study could be designed to determine if self-referent subjects, given adequate amounts of learning time per word, would then outperform traditional keyword and/or familiar-referent (plausible imagery) subjects.

In experiment 3 of this same study, traditional keyword imagery was compared to a multiple-context language strategy and here keyword subjects obtained the higher group mean. Experimental words and procedures were identical to those of the two previous experiments.

In experiments 4 and 5, recall tests were under investigation with four experimental groups (keyword imagery, imagery definition, synonym, and free choice control). In experiment 4, the dependent measure was a matching test. In experiment 5, the dependent measure was a recognition test in which one-third of the answers provided were the actual definitions; the other two-thirds (distractors) consisted of keywords. In the matching task, keyword subjects obtained the highest group mean, with imagery definition and synonym subjects obtaining similar scores to each other. However, in experiment 5, when keywords were presented in the list of possible choices (as distractors) keyword imagery subjects experienced diffic[illegible] distractors from true definitions and [illegible] had scores lower than the other three experimental [illegible]. It should be noted that keyword imagery subjects [illegible] presented with retrieval orientation information prior [illegible] recall. Such a strategy might have prevented them from mistakenly identifying keywords as definitions.

Imposed Versus Induced Imagery

In the present investigation, the experimental subjects were provided with connecting imagery to link keywords derived from the vocabulary (to be learned) with their respective definitions. Because of its importance in this research and in mnemonic applications generally, this section is included to discuss imagery, experimenter-imposed and subject-induced imagery and their roles in learning, image vividness, and additional experimentation involving imagery.

Levin (1976) distinguished between two types of imagery elaboration strategies and labeled them "induced" and "imposed." An example of imposed, imaginal elaboration would be when experimenters provide the keywords, interacting pictures, or interaction sentences for the subjects. Induced means that the subject, after initial mnemonic training, must create his or her own connecting visual images.

A distinction has been made between experimenter-imposed and subject-induced imagery that is characteristic of all paired-associate imaginal learning tasks. Paivio (1969) noted that adult [illegible] imagery, tasks when they are re[illegible] their own mental images However, this [illegible]ated in some keyword studies. Atkinson, [illegible] that adult subjects outperformed other [illegible] required to generate their own images, [illegible] Levin, Nakamura, et al (1980) suggested t[illegible] words with easily derived mediators, it made little difference whether the suggested image was provided by the experimenter or self-generated.

Bower and Winzenz (1970) and Bugelski (1970) concluded that when mnemonic subjects are supplied with a list of words and a mnemonic system for remembering those words, it is better for the subject to supply his own "mental picture." However, this finding does not hold for young children. Pressley and Levin (1978) discovered that second graders who were asked to form their own mental images recalled fewer Spanish words and their translations than did subjects who were provided with interactive pictures by the experimenter prior to recall.

Garten and Blick (1974) used college undergraduates to test the effectiveness of induced versus imposed imagery mnemonics. Students using either imposed or induced keyword aids scored better than control subjects at the recall times of two days after and then one week after training At an elapsed time of 8 weeks, the use of subject-induced mnemonics produced more effective recall than controls for the 10 English nouns, while experimenter-imposed mnemonics produced no differences when compared with controls.

In summary, subject-induced imagery is more effective for recall in adults, while recall in children is enhanced by experimenter-imposed imagery. Regardless of age, experimenter-imposed imagery significantly aids learner performance when the subject material is too complex to be easily visualized or imaged (Levin, 1981).

When the keyword method was employed with college students for the learning of Latin words (Pressley, Levin, Nakamura, et al., 1980), only one negative drawback was discovered: the use of keywords may increase spelling errors. However, three positive findings, reported for five experimental conditions, included: (1) that the keyword method is effectively employed by both poor and excellent language learners; (2) that the keyword method, when used with easily visualized items, can be just as effectively employed with subject-induced or experimenter-imposed imagery.

However, Hall et al. (1981) concluded that ". . . the requirement of generating one's keyword resulted in performance markedly inferior to either the keyword-provided or the control condition" (p. 352) in a series of four experiments involving college students learning Spanish.

It has been noted that vividness in visualization aids in recall (Montague & Carter, 1974) of word lists. There are several studies w[illegible] al associations should be vivid In one stu[illegible] ted the vividness of their images as they [illegible] The more vivid the images were rated, th[illegible] ere remembered (Bower, 1972). Denlin (1969a[illegible] at students instructed to make vivid mental images tende[illegible] remember a word list better than students told only to "form mental images."

Shriberg et al. (1982) investigated the effect of presenting mnemonic picture representations, in conjunction with prose passages, to facilitate recall of fictitious famous persons and their achievements using eighth grade students. In two experimental conditions there was consistent superior statistical support for both picture and keyword imagery conditions over controls for name-accomplishment information. Elaborate pictures subsequently presented in experiment 2 were also shown to elicit superior recall of detailed information.

In experiment 3, a distinction was made between two types of imagery that have been used with the keyword method It was reported that Levin et al. (1979) distinguished between representational and transformational imagery. Representational imagery is characterized by words that do not need to be represented by a homophone. For example, if a person's last name is Tailor, the image of a tailor is readily available—a similar-sounding keyword is not needed. However, in transformational imagery, there is an additional "transforming" step that is required. If a person's last name is Taylor, the imager must convert Taylor into tailor—its homophone—so that the name can be easily visualized and remembered. The hypothesis tested in Experiment 3 was concerned with these two imagery distinctions. It was predicted that the recall percentage differences would be greater between transformational imagers and their controls than between representational imagers and their controls. This hypothesis was supported for the main name-accomplishment information.

Group Administered Keyword Studies

Positive effects of the keyword method have not emerged under group administration procedures except when the method has been presented with elementary school children. This finding could be due to a number of reasons. Resistance to new learning strategies may increase with age, or it could be that retrieval orientation information, which has not been provided in traditional keyword studies to either adults or children, needs to be provided in order for adults to implement the keyword method effectively.

In this section, seven studies are discussed, two of which investigated adults using group administration procedures but did not obtain positive keyword results. The first and second studies cited herein discuss how Jones and Hall (1982) investigated the variables of transference and group administration procedures for the keyword method, and how researchers [illegible] et [illegible] six experiments in order to investig[illegible] of group administration. Positive group ef[illegible] the keyword method were obtained in these two studies only when Levin et al. (1979) used fifth grade students (experiments 5 and 6, as opposed to high school students in experiments 1 and 2), and when Jones and Hall (1982) used eighth grade students.

Jones and Hall (1982) investigated whether the keyword method would (1) be appropriate for other kinds of paired-associate learning tasks besides language acquisition and (2) once learned, be transferred to other learning tasks. A total of 42 eighth grade children were tested in two intact classrooms (21 in each room); one classroom applied the keyword method; the other classroom was used as a control group and received an equal amount of verbal training in non-mnemonic organizational strategies. The two groups were considered to be equivalent in ability based on (1) school officials' reports that assignment to classes was unsystematic, and (2) achievement test scores.

After a total of five training sessions, both groups received a "famous persons' names and their achievements" test that was based on factual characters and their accomplishments (rather than fictional information, which was provided in the fifth training session). Keyword subjects recalled 13.4 of the 21 paired-associate tasks while controls recalled 8.9 of the same pairs, a difference statistically significant at the [illegible] level. Keyword subjects also outperformed controls on a medical term task that was given one week after the training period. Hence, the effects of transference and group administration procedures both produced significant statistical results in this study.

Levin et al (1979) attempted to challenge Fuentes' (1976) dissertation finding that the use of the keyword method in intact classrooms (group procedures) does not increase the immediate retention rate for foreign vocabulary words. Although many criticisms were leveled at the Fuentes study (i.e., ceiling effect, subject selection, sophistication of mnemonic techniques already developed in second year high school language students, leakage, and mixed variety of grammatical form classes), the only variables that were studied by Levin et al (1979) under six experimental conditions were those of (1) selection (age and proficiency already obtained in Spanish prior to the study), (2) individual versus group testing procedures, and (3) whether instructions were read orally (by the experimenter) or silently.

Experiments 1 and 2 used intact classrooms, silent reading procedures, and second and first year high school Spanish students, respectively. No differences were found under either experimental condition for mnemonic and control subjects when comparing the number of English equivalents [illegible] were [illegible] words after 10 minutes' exposure. In experiments 3 [illegible] directions were presented orally with individuals and [illegible] intact classrooms, respectively, employing first year Spanish students. Here a difference in the means of controls versus mnemonic subjects became apparent when students were given individual, oral instructions (experiment 3).

In experiments 5 and 6, the results significantly supported that mnemonics could be effectively employed in both individually administered and group administered procedures. However, the experimenters tested fifth grade students rather than high school students, in these two experiments. Experiment 5 became, in actuality, a replication of an experiment Pressley (1977) conducted earlier, involving second and fifth grade children. The one slight difference between the Pressley (1977) study and experiment 5 was that the more recent study used only two experimental groups (mnemonics versus controls) rather than three experimental groups. The earlier study employed a control group that was not exposed in any way to the concept of keywords. In the Levin et al. (1979) experiment 5, controls were exposed to the keywords but were told that their purpose was for helping in pronunciation rather than for visualization and recall. In both experiments 5 and 6, mnemonic subjects recalled approximately 10 words (English equivalents) of 18, while controls recalled only about 5 out of 18 words.

[illegible] by Hall et al. (1981) [illegible], group administration procedures. In the first experiment, 60 undergraduate students were randomly assigned to one of three conditions: Experimenter-imposed keyword imagery; subject-induced keyword imagery; or free choice control. The task was to learn 30 English definitions for Spanish words during a study period of 10 minutes. The subjects were tested for recall immediately after instruction and again after 1 week. Hall et al. (1981) found (1) no statistically significant differences between experimenter-imposed keyword subjects and controls on a test of immediate recall, (2) that those students who devised their own keywords recalled fewer definitions than the controls, and (3) that delayed retention scores were similar for all three groups at the end of a week. Unlike the present study, the experimental method used no retrieval strategy.

In direct response to this study, Pressley, Levin, Digdon, Bryant, McGivern, & Ray (1982) conducted four experiments to dispute the claim of Hall et al. (1981) that sophisticated learners cannot benefit from the keyword method unless the experimenter artificially paces the words (e.g., at the 10 second rate used by Pressley et al. in the four experiments). In the first two experiments, college subjects were paced and unpaced with individual presentations. In the second two experiments, subjects were again paced and unpaced but with group administration presentations. The keyword subjects consistently obtained the higher means, whether paced or unpaced, unless they had been group administered. This finding led Pressley et al. to conclude that the "limitations" of the keyword method (the word "limitations" was used first by Hall et al. (1981) stemmed not from the pacing variable but from group administration.

McNeal (1973) used a matching strategy to assign 114 college subjects to one of six experimental conditions. There were three learning methods presented (keyword, rote repetition, and free choice control) and 19 subjects per group. Their task was to learn 35 Graduate Record Examination level vocabulary words in either 5 minutes or an unlimited amount of study time. There were no significant differences across treatments, but unlimited study subjects scored significantly higher than the 5 minute study subjects.

However, several methdological problems may have contributed to McNeal's lack of significant findings: (1) McNeal's subjects were permitted to have access to all 35 experimental words at once. Bellezza (1981) noted: "Problems may also arise when all the items are presented simultaneously to subjects. . . . subjects may be tempted to group or associate the items to one another. . . ." (p. 267), thereby using other mnemonic strategies, other than the keyword method, to assist them in vocabulary learning and recall. (2) McNeal provided only one example of the mnemonic method to the keyword subjects prior to the learning task. Not only was the single example probably insufficient for subject comprehension, but the example itself methodologically suspect.

After briefly explaining the mnemonic keyword method to the subjects, McNeal then provided them with the following written example:

> The idea is to form an image of the word and its meaning that acts as a connection between the two. In this case you take the stimulus word, the one you wish to recall, and form an image in your mind relating the word to its meaning. Take the word furcate. The dictionary meaning of this word is to branch. Visualize the word furcate and think of yourself walking toward a giant fir tree that has two distinct forks. Now visualize the word furcate and connect it to the forked fir tree. Imagery does improve with practice if you learn to use some of the successful techniques that are suggested:
>
> 1. Involve yourself and make sure of your experiences.
> 2. Make vivid images with action in time.
> 3. The more odd and uninhibited your images, the better. Associating furcate with the

> image of a forked fir tree a few times will give you a lasting knowledge of the word. You can probably make a much clearer image than the one suggested for this word (p. 22)

Using guidelines established by researchers Pressley, Levin, and Delaney (1982) and Raugh and Atkinson (1975) for defining the keyword method and its proper implementation, three inconsistencies arise in McNeal's keyword explanation.

1) The vocabulary word itself is not to be visualized. McNeal instructed subjects to visualize the word furcate and connect it to a forked fir tree. "Fur" is what would be visualized if one were employing the keyword method according to guidelines established by the above named researchers.

2) McNeal recommended to his subjects that their images be "odd and uninhibited" despite research findings that suggest this variable is not necessary (Wood, 1967, Higbee, 1976a).

3) McNeal suggested that "furcate" be imaged a "few times" with a forked fir tree. However, once the image has been formed, it is recommended by the other researchers that subjects move on to the next word and definition.

In a follow up questionnaire, 24% of McNeal's mnemonic subjects indicated that they had not used the technique as specified. This is a significantly large number of subjects and thus helps to further question McNeal's experimental procedures and findings.

Singer (1977) used the keyword method to teach French vocabulary to inner-city junior high students. On the first day of group keyword instruction (oral), five words and definitions were provided as examples with experimenter-imposed imagery. On the following three days, students were encouraged, as a group, to think up as many visual images for each word and definition. Singer (1977) reported that not only did a high percentage of students recall the 20 words and definitions but that student motivation for learning French was greatly increased. After a brief 10 minute review following a 10 day spring break, delayed recall scores in four junior high classes averaged from 68.4% to 98.6%.

Individual Testing of Adult Subjects

In contrast to the negative results obtained for the keyword method in the two previously cited studies, two English keyword studies have been conducted with college subjects in which keyword participants obtained higher group scores when individually tested.

In the first experiment, Pressley and Levin (1981) attempted to discover the effect of backward recall on subjects (i.e., subjects were presented with the definitions at the time of recall and asked to write the corresponding vocabulary word). Only those subjects who integrated uncommon English words into cognitive structure prior to keyword presentation were able to recall a significantly larger percentage of [illegible] with their definitions) over controls.

In the second experiment the effect of the keyword method on comprehension and usage in a novel context was investigated (Pressley, Levin, & Miller, 1981) in four experimental conditions. There was statistical evidence on immediate recall tasks that keyword subjects comprehend English vocabulary words and their meanings both in context and in unusual contexts better than controls. Although obtaining predictable favorable results which support the keyword method, Pressley et al. (above) realized the limitations of their study. In concluding remarks, they wrote, ". . . the keyword method has yet to prove itself effective in classrooms with older children and adults, . . ." (p.) acknowledging that in spite of their favorable findings, the keyword method in classrooms has not yet produced significant statistical results.

Time Factors

Time factors refer to the amount of time subjects have been permitted to study material via a mnemonic learning strategy. Also known as the "pacing variable" (Pressley, Levin, & Delaney, 1982), only one recent study (Hall et al., 1981, experiment 4) has investigated the effect of time factors on mnemonic subjects.

It was discovered that superiority for the keyword method appeared if and only if the experimenter paced the word-definition presentation [illegible] thereby controlling major study conditions. But a greater number of definitions (for Spanish words) were recalled by both controls and keyword subjects when free study time was permitted, although statistically significant differences were then not obtained.

Mnemonic subjects have been presented with time limitations of 4 seconds per item to 10 minutes per set of items. It has been noted that mnemonic subjects need more time per item (approximately 4 to 8 seconds) in order to learn a list of words, but that recall is superior for mnemonic subjects and that learning takes fewer trials than controls using rote repetition (Bugelski, 1968). Similar results were obtained by Berla et al. (1969), when 56 male and female subjects were randomly assigned to mnemonic or control groups. Mnemonic subjects were given approximately 30 minutes of training, while controls were given an equal amount of time to practice two lists (20 words each) using traditional rote repetition procedures. Both groups were then required to practice a new list of 20 words until it was totally memorized. Mnemonic subjects learned the list in significantly less time (fewer trials) than did rote-control subjects (Berla et al., 1969).

McNeal (1973) (previously cited) discovered that mnemonic subjects, given an unlimited amount of study time, used an average of 12.16 minutes to study a list of 35

Graduate Record [illegible] words and definitions. Free [illegible] rote repetition subjects used an average of [illegible] .98 minutes, respectively, to study the same words. However, when a correlation matrix was calculated for the 57 subjects who received the unlimited study time, there appeared to be no relationship between the amount of time a subject studied (across treatments) and the number of correct responses on either tests of immediate or delayed recall.

The Effects of Immediate Versus Delayed Retention

Since mnemonics were designed mainly as time-saving devices (Bellezza, 1981), a question of long term or delayed retention remains only partially answered by a handful of research studies. Some researchers have obtained positive long term results in favor of mnemonic subjects (Soltwood & Black, 1970; Pines & Black, 1974) while others claim that all information becomes lost, or at least partially inaccessible over time, no matter what learning strategy was employed at the time of encoding (Atkinson, 1975).

A keyword-like method was employed in teaching "demonic spelling words" to sixth grade students (Negin, 1978). Two hours of mnemonic instruction were provided to 21 randomly assigned subjects on individualized, custom-designed spelling lists. Ten words from each student's own misspellings were randomly selected for mnemonic and control group implementation each week for 10 weeks. A typical word, such as "resistance," would be capitalized in the problem area (such as TAN in resisTANce) and mnemonic subjects were then instructed to form a connecting visual image between the words "resistance" and "tan." Control subjects formed sentences out of their misspelled words and were directed to underline the problem area(s) of a word but they were not instructed to form keywords or visual images based on those problem areas.

On weekly immediate recall tests, there were no significant differences between the two groups. However, when a surprise test was administered to all students during the tenth week of the program, mnemonic subjects correctly spelled a significantly greater number of the 60 words than did controls.

In another experiment, students were taught a total of 25 states and their capitals employing a dual keyword method (Levin et al., 1980). First, the state names were converted to keywords, such as "marry" for Maryland. Second, the capitals were converted to keywords, also imposed by the experimenters, such as "apple" for Annapolis. In the third phase of instruction, mnemonic subjects were told to connect both keywords together for each state-capital pair in order to enhance recall. Pictures were provided of these interactions, such as two apples getting married to remember Annapolis-Maryland. The most dramatic results were obtained on a third day delayed recall test. When compared with control [illegible] mnemonic subjects demonstrated a recall gain of nearly 200%.

Dansereau (1975) compared mnemonic strategies for learning and recall of academic material with more traditional-type methods, such as question-and-answer procedures, for the United States Air Force training program. A program was developed for teaching selected strategies, such as paraphrasing, question-answering, and the use of visual imagery. Minimal mnemonic strategy training showed significant results in long term retention. Dansereau noted ". . . this project has proven to be very successful, an effective strategy training program has been created, modified, and assessed. We feel this training program is sufficiently effective to warrant immediate implementation" (p. 2). Dansereau (1975) thereby recommended that the question-and-answer procedure be discontinued in Air Force learning tasks.

As previously cited by Hall et al. (1981), free study time was selected as the variable of interest in regards to long term retention of the English equivalents for 24 Spanish words (experiment 3). No statistically significant differences between keyword subjects and controls were discovered at the end of 1 week. Hall et al. (1981) thereby wrote, ". . . insofar as long term retention is concerned (given equivalent original learning), there is neither an advantage nor a disadvantage to the use of the keyword method" (p. 352).

McNeal ([illegible] treatments in [illegible] ion (of two weeks) [illegible] 114 college subjects to three trea[illegible]tation, free choice) for the learning [illegible] nation level vocabulary words [illegible]

[illegible]

When the keyword metho[illegible] its historical perspective among mnemonic subj[illegible] appears that the keyword method has been investigated [illegible] more diversified and practical learning situations than any other mnemonic system (Pressley, Levin, & Delaney, 1982). The greatest thrust thus far has been investigating the application of the keyword method to foreign language studies. The research indicates that the keyword method can aid in the enhancement of foreign language learning, thereby making the learner's task less difficult. This has held for every language in which the keyword method has been utilized. Offshoots from language applications have included recalling words lists, improving reading comprehension, learning shorthand and semantic training of the mentally retarded.

In using the keyword method, it is important to distinguish between "induced" and "imposed" imagery, the former arises from subject-generation and the latter is provided by the experimenter. While some researchers conclude that adult subjects obtain higher mnemonic scores when they are asked to create their own images (Higbee, 1976a), other researchers have concluded that it makes no difference whether the images are experimenter-imposed or subject-induced (Pressley, Levin, Nakamura, Hope, Bispo, & Toye, 1980). Still others have concluded that adults, as well as children, obtain superior keyword scores only when the images are experimenter-imposed (Hall et al., 1980).

Group administered procedures have not obtained higher mnemonic scores with high school and college subjects with one exception: Hall et al. (1981) obtained a significant group score for keyword subjects when he paced them at the 10 second rate.

Keyword method subjects have obtained higher scores in comparison with rote repetition and free choice subjects, given the limitations of experimenter-paced words and definitions of 10 seconds, and with individual testing (Pressley, Levin, Nakamura, Hope, Bispo, & Toye, 1980). The keyword method has also proven itself effective with all age groups, including preschool children (Pressley, Levin, & McCormick, 1980), and group administration procedures have also obtained high keyword scores when tested with elementary students (Levin et al., 1979). Current research indicates that the keyword method has been most effective when taught to subjects on an individual basis (Pressley, Levin, & Delaney, 1982), and findings seem to apply in general to both children and adults, although some methodological problems may have contributed to this conclusion.

The rate of 10 seconds has been the typical time chosen by researchers who found consistently superior keyword scores (Pressley, [illegible], & Miller, 1981). When subjects have been provided with either unlimited study time or even 10 minutes of study time for a particular task, no significant differences in favor of keyword subjects have been found. Pressley et al. (1981) refer to this phenomenon as the "ceiling effect," i.e., too much time and too few words.

The effects of immediate versus delayed retention using the keyword method have provided mixed results. In one experiment involving spelling words at the elementary school level, no differences were obtained on immediate recall tasks, but significant differences were obtained for the keyword subjects when tested at the end of 10 weeks (Negin, 1978). Similarly, dramatic results were obtained not on immediate but on delayed tests for subjects who used a dual keyword method for learning states and their capitals (Levin et al., 1980). Long term retention results were also superior in Air Force programs for mnemonic subjects (Dansereau, 1975); however, Hall et al. (1981) and McNeal (1973) obtained no significant differences on either immediate or delayed retention tests for keyword college subjects, indicating that thus far, the only favorable results for the keyword method in tasks of delayed recall (with adults) occurred only in the Air Force training program. Pressley et al. (1982) have virtually always tested adults individually on tests of [illegible] result [illegible] [illegible] [illegible]

results for [illegible]

CHAPTER III
METHOD

The purpose of the present study was to examine the keyword method in relation to the learning of unfamiliar English vocabulary words by 110 volunteer subjects under group administered procedures. The effectiveness of two keyword methods was compared and a free choice control group was provided in order to gauge relative effectiveness in retention rates of immediate and delayed recall tasks.

Two hypotheses emerged from the present study:

Hypothesis I. There are no statistically significant differences in the number of vocabulary definitions recalled between group administered keyword encoding subjects, keyword encoding plus retrieval orientation information subjects, and free choice control subjects in a test of immediate recall.

Hypothesis II. In a delayed recall test of 1 week, there are no statistically significant differences in the recall scores of keyword encoding subjects, keyword encoding plus retrieval orientation information subjects, and free choice control subjects.

Pilot Studies

Three pilot studies were conducted prior to actual experimental sessions with a minimum of nine college students, three in each condition, to estimate the approximate amount of time that should be allotted for the learning of each word and definition. In the first pilot study, 60 seconds were allotted, all groups indicated that 1 minute was too much learning time. In the second pilot study, 30 seconds were allotted per group; here, subjects from the free choice and keyword encoding retrieval (KER) groups indicated that 30 seconds was not enough time. In the third pilot study, all subjects in all conditions indicated that 45 seconds of study time per word was adequate. Based on these findings it was determined that 45 seconds be allotted per word. Complete data for each pilot study are presented in Chapter IV.

In addition to the pilot testing results, a presentation rate of 45 seconds per word was selected as a compromise between presenting subjects with all words and definitions at once (Hall et al., 1981) and presenting subjects with 10 second paced words (which Pressley and associates typically chose). This compromise was suggested for the following reasons. First, when subjects are permitted to have access to all experimental words at once, subjects may be tempted to "group or associate the items to one another" thereby using mnemonic strategies other than the keyword method to assist them in vocabulary recall [illegible] ord results may be contaminated by such an unco[illegible] procedure. On the other hand, the investigator ac[illegible] Hall et al. (1981) that a 10 second paced presentat[illegible] is rather unreasonable. Hall et al. (1981) stated [illegible] toward our between-subjects design in which the groups are given equal functional study time and the control subjects are encouraged to generate an effective study method of their choice as a more reasonable approach than experimenter-paced presentation to the evaluation of the effectiveness of the keyword method" (p. 352).

They later stated in that same study, " . . . simultaneous presentation procedure would better simulate study conditions and thus would provide a more appropriate context in which to evaluate the keyword method in terms of retention" (p. 356). But as Bellezza (1981) cautioned, other systems besides the keyword method may be operating when subjects are permitted to view all words simultaneously. In the Hall et al. (1981) study, college subjects were provided with 10 minutes to study simultaneously 30 Spanish-English word pairs prior to testing. Therefore, the compromise of experimenter-paced words and definitions of 45 seconds per word and definition was chosen in the present study across treatments to enhance experimental investigation of the effects of retrieval orientation information since no other time per word and definition was established previously for appropriate group testing procedures. Pilot study data supported the 45 second rate.

A secondary purpose of the three pilot studies was to determine if the procedures could be processed as expected. By the third pilot study, procedures were conducted smoothly. None of the pilot study subjects were used in the actual experiment.

Experiment

Subjects

One-hundred and ten volunteer subjects (41 males, 69 females) were assigned randomly to one of three conditions: Keyword encoding ($n = 37$) (KE); keyword encoding plus retrieval ($n = 37$) (KER), or free choice control condition ($n = 36$) (FCC). The subjects were recruited from three University of Florida lecture halls during scheduled class time. Nearly two-thirds of the volunteers were recruited from two introductory calculus courses (63.30%), while 36.70% of the volunteers were obtained from an undergraduate human development course.

Analysis of personal data sheets (see Appendix H) obtained on the day of the initial experiment (immediate recall) indicated that the students were from a wide variety of academic majors (22 different majors were indicated in all) and that 95% of them were white Americans. Two black Americans participated in this keyword experiment (one in KE, one in KER), and three non-Americans volunteered for participation: A black Jamaican was assigned to the control group; a Filipino was assigned to the KER group, and a Venezuelan was assigned to the KE group. Examination of foreign student scores showed that they were not atypical and therefore they were not dropped from the analyses.

Age. Participants' ages ranged from 17 to 51 years old, but all except 14 of the 110 subjects were between 18 and 22 years old. The median age for KE, KER, and FCC subjects was 19.1, 18.9, and 20.5, respectively.

Sex. A breakdown of sex by group was as follows: There were 13 males and 24 females in the KE group, there were 14 males and 23 females in the KER group, and there were 14 males and 22 females in the control group.

Academic Status. Representative percentages for each academic class are listed in Appendix G. More juniors participated than any other class (38.53%), while seniors accounted for the least number of volunteers (9.17%). Freshmen and sophomores accounted for 22.07% and 20.28% of the volunteers respectively. Only one graduate student registered, and one participant indicated that he was not currently enrolled in college (age 51).

Grade point average (GPA). Overall grade point averages for KE, KER, and FCC subjects were calculated as 2.76, 2.81, and 3.04, respectively, with a range of 1.5 to 3.6 for KE subjects, a range of 1.8 to 3.8 for KER subjects, and a range of 2.0 to 3.9 for free choice controls (on a 4.0 maximum scale). The standard deviations for KE, KER, and FCC groups on GPA were 0.51, 0.66, and 0.47, respectively.

Materials

The present study used 31 of the same 32 words and identical definitions that Pressley, Levin, and Miller (1981) used in their study. One word was eliminated (fumitory) that Pressley et al. inadvertantly included. All of the other 31 words contained the actual keywords in their correct spelling form; for instance, the keyword for cowry was cow and the keyword for dogger was dog in the Pressley et al. study. However, the keyword for fumitory (fume) could not be readily obtained and researchers reported that they "inadvertently" included this word. Hence, the word "fumitory" was eliminated from the present study. These 32 words were chosen by Pressley et al. because of their low frequency of English usage and because they asumed these words would be unfamiliar to college students. A follow-up study confirmed that assumption (Pressley, Levin, & Miller, 1981).

A single word and its definition appeared typewritten across the top of each 8 1/2" X 11 1/2" white sheet of paper for each treatment group (see Appendix A for samples). For the keyword encoding group (KE), experimenter-imposed keyword imagery information followed beneath each typed word, definition, and keyword. For the keyword encoding plus retrieval information group (KER), additional information concerning how the keyword method would assist the learner during recall was included. Free choice control subjects (FCC) were simply provided with the word and definition and instructed to use their own strategies in order to enhance recall. All

31 words and defin[illegible] in identical order across conditions for all [illegible]

Procedure

All subjects w[illegible]ously in a University of Florida lecture [illegible] volunteers entered the auditorium, they were [illegible] treatment group to which they had been random[illegible] in advance by means of a table of random numbers Large numbers had been placed on the backs of the auditorium chairs to indicate where subjects should be seated

When 110 volunteer subjects had arrived at the auditorium, a consent form was passed out to each person (Appendix B) The consent form listed procedures and the nature of the task, and the experimenter's name, address, and telephone numbers were also provided. Subjects were asked to read carefully, then to sign the bottom of the consent form while keeping the top part of the sheet for their own records.

After all consent forms had been read and signed (no volunteer refused), experimental learning materials were distributed face down to each subject. The materials consisted of 33 8 1/2" X 11" white, typewritten stapled pages. The first two sheets included directions for each of the three conditions. Three identical words and definitions were provided as examples across treatments (Appendix C) and these words were not included as part of the 31 experimental words and definitions. Subjects were given an unlimited amount of time to read the directions, with all subjects indicating they had read the two pages of instructions within 15 minutes. No questions of clarification were asked of the experimenter. The remaining 31 pages contained one and only one vocabulary word per page plus other specific information appropriate for each treatment group.

All subjects were given 45 seconds to study each and every word in accordance with the procedures specified for each group. The experimentor, with watch in hand, called time at the end of every 45 second period by repeatedly announcing, "Time is up. Please go on to the next word." Three assistants monitored all subjects to verify they were following directions as specified.

Immediately following the study situation, all booklets were collected, and subjects received a recall test. All 31 words were provided in the same order for all subjects, but in a different order from the teaching list. Subjects were required to write the words' definitions. All subjects were given an unlimited amount of time to complete the test, but no subject required more than 10 minutes for test completion. Subjects were not informed that in 1 week they would receive a follow up recall test, administered in the same manner, over the same 31 words. Upon retesting, procedures (i.e., study strategies) of free choice subjects were also collected (See Appendix F)

[illegible]

In [illegible] experim[illegible] than recognition of the 31 words' definit[illegible] [illegible]estigation. Therefore, multiple choic[illegible] [illegible] as being appropriate.

Criteria for awarding [illegible] two points were determined in the following manner.

Full credit. All definitions that had exact or nearly the same wording were given two points. For instance, casern, which Pressley, Levin, and Miller (1981) defined as "barracks for soldiers" was also given full credit if a subject defined it as "soldiers' barracks," "army barracks," or simply "barracks." In addition, any definition that contained words that were unnecessary to the understanding of the meaning of the word were also given two points credit if the extraneous words were deleted. For example, Pressley et al. defined claymore as "a type of sword." In this definition, the phrase "type of" was interpreted as being extraneous; therefore, full credit was awarded to each subject who correctly defined claymore simply as "sword." Likewise, when a definition was the same or similar to the definition used by Pressley et al., the subject received full credit. For example, one subject received full credit for defining inkle as a "linen tape used for lining garments" (rather than hemming garments), and another subject received full credit for defining cowry as "delicate seashells" (rather than glassy seashells).

Half credit. When any word or phrase was missing and considered essential by this experimenter to the essence of the definition, only one point was awarded. For example, tarn was defined as "a small mountain lake." Subjects who failed to include either the word "mountain" or "lake" were given only one point credit, but subjects who deleted the word "small" received full credit; therefore adjectives such as "small," "white," and "baked" were not considered essential to the definition. However, in the definition for antiar ("a poison used on arrows by natives"), all three nouns were considered essential in order for a subject to receive full credit. Examples of responses which received only partial credit include: "a poison used by natives," "a poison arrow," "a type of poison," "poison tipped arrow." Here, either the essential word "arrow" or "natives" was deleted (see Appendix D for a listing of all 31 words and their definitions as they appeared in the experiment). Other examples which follow the above guidelines for awarding one point credit for a subject's response include: bustard—"a small exotic bird" (instead of "a type of game bird"); ratine—"a fabric" (instead of "a heavy fabric"), piggin—"a wooden bucket" (instead of "a small wooden pail"); lapidist—"precious stone keeper" (instead of "one who deals in precious stones"); cordite—"an explosion (powerful)—smoky" (instead of "an explosive powder"); and lumper—"person who unloads things" (instead of "one who loads or unloads boats").

No credit. No credit was awarded when a subject indicated a correct adjective but an incorrect noun for a word's definition. For instance, no credit was given to a subject who described piggin as "a wooden box," even though the word "wooden" appears in the definition. A subject who defined ramekin as "something about cooking," although somewhat correct, was given no credit for failing to mention anything about either "baked," "cheese," or "dish." Likewise, a subject who described cordite as "using smoke" received no credit, and a person who defined bustard as "a type of game fish" also received no credit.

Using the above detailed guidelines, three University of Florida professors serving as expert judges independently scored 30 randomly selected immediate and delayed recall tests to check for consistency with the experimenter's scoring decisions. In order to determine the percentage of agreement between the experimenter's ratings and the professors' ratings, each item was compared to the experimenter's ratings and an absolute value of differences was calculated for each item. When the grand total differences were calculated it was determined that the professors agreed independently with the experimenter's ratings 90.4% of the time, with an overall range of 78% to 99% agreement for both immediate and delayed recall ratings.

Statistical Analysis

The dependent variables were scores obtained on immediate and delayed recall tests of the 31 vocabulary words' definitions. The recall test consisted of the 31 vocabulary words with instructions to write the definition of the word in the space provided (see Appendix E). All responses were awarded either one, two, or zero points.

The research design consisted of two one-way ANOVAs tested at an alpha level of significance of .05. The independent variable was group membership, as illustrated in Table 1 below.

Table 1
Research Design of Present Study

Testing	Experimental Groups		
Immediate Recall	Keyword Encoding	Keyword Retrieval	Control
Delayed Recall	Keyword Encoding	Keyword Retrieval	Control

CHAPTER IV
RESULTS

In the present study, the keyword method was administered to two groups; one of these groups also received instructions for word retrieval. A control group was also present and used methods of their own device for learning and recall of 31 English vocabulary words and their definitions. This study attempted to determine which group administered procedure, if any, was most effective in tests of immediate and delayed recall of 1 week.

Pilot Studies

Three pilot studies were conducted to determine if the administration procedures used were sound and also to investigate the variable of time. Procedures progressed successively with each administration.

First Pilot Study

The first group of volunteers were obtained from a graduate level course in theories of learning, offered by the Foundations of Education Department at the University of Florida. Ten graduate students (3 KE, 4 KEN, 3 FCC) were given 60 seconds per word of learning time. Eight of the 10 indicated afterwards that 1 minute per word was too lengthy.

[illegible] differences [illegible] treatments with means of 27.5 (KE), 35.5 (KER), and 19.[illegible] obtained by free choice subjects. Four students indicated they were unable to visualize the suggested images for the words gaskin and piggin, so these imagery suggestions were changed for subsequent testing. Only 20 of the 31 words were randomly selected for testing.

Second Pilot Study

Nine undergraduates were offered five dollar gift coupons for professional typing in exchange for their participation in a pilot study. Students were given 30 seconds per word of learning time and three out of the nine subjects indicated that one-half minute was too short (two of those three were in the KER group, one in the free choice group). None of the KE subjects complained about the 30 second time limit and this group obtained the highest group mean: 44.33 (KE), 29.66 (KER), and 30.0 (FCC). Since the experimenter searched for a time that would be equally satisfying for all subjects across treatments, a third pilot study was conducted.

Third Pilot Study

Fourteen undergraduate students from an educational psychology classroom were given 45 seconds to learn each word and definition (5 KE, 5 KER, 4 FCC). All subjects indicated afterwards that 45 seconds was a good amount of time. Mean differences occurred across treatments: 49.0 (KL), 50.4 (KER), and 42.75 (FCC). Procedures were administered smoothly; papers were distributed and collected with a minimum of involvement.

Equality of Treatment Groups

This analysis began with a chi-square (Appendix G) to determine if there were any differences in the distribution of students to the three treatment groups by grade level. The chi-square analysis indicated that the differences of distribution of students to the three treatment groups for each grade level were not statistically significant (χ^2 = 9.376, p = .1535).

Data Analysis

Mean recall for both immediate and delayed recall is reported in Table 2 for each experimental group. In each recall test, the data were analyzed by use of a one-way analysis of variance followed by all pairwise comparisons using the Bonferroni procedure. Based on 107 degrees of freedom, the mean square error was 164.98 for immediate recall and 185.40 for delayed recall. All sources of variance were tested at a Type I error probability of .05.

Table 2
Means and Standard Deviations of
Immediate and Delayed Recall

	Group		
Statistic	Keyword Encoding	Keyword Retrieval	Control
	Immediate Recall ($N = 110$)		
Mean	40.78	44.73	35.31
SD	11.77	12.05	14.57
	Delayed Recall ($N = 75$)		
Mean	21.96	31.79	21.00
SD	13.11	13.76	11.51

Immediate Recall

Hypothesis I

Hypothesis I stated "there are no statistically significant differences in the number of vocabulary definitions recalled between keyword encoding subjects (KE), keyword plus retrieval orientation information subjects (KER), and free choice control subjects (FCC) in a test of immediate recall."

The means (see Table 2) for the KE, KER, and FCC groups were 40.78, 44.73, and 35.31, respectively ($F = 4.95$, $p < .0088$). This hypothesis was therefore rejected. In interpreting these means it should be noted that the range of values that a subject could obtain was either two, one, or zero points for each correct, partially correct, or incorrect response, respectively, with a maximum of 62 points. To identify specifically where the differences existed, the Bonferroni procedure (three pairwise comparisons) was conducted (Table 3), with the following results. For immediate recall (test 1) there were no statistically significant differences between KE and FCC groups. This finding has been consistently supported by the keyword literature (Pressley, Levin, & Delaney, 1982) when subjects have been group tested. Although there were no statistically significant differences between KE and KER groups during immediate recall, a statistically significant difference between KER and FCC subjects was apparent.

Table 3
All Pairwise Comparisons Using the Bonferroni t in Immediate Recall

Parameter	Estimate	*p*	Standard Error of Estimate
KE vs. KER	-3.9459	0.1892	2.9863
KE vs. FCC	5.4782	0.0713	3.0069
KER vs. FCC	9.4241	0.0022[a]	3.0069

[a] Bonferroni criteria < 0.0167

Attrition Subjects

Thirty-five subjects did not return for the delayed recall testing session (9 KE, 13 KER, 13 FCC). When attrition subjects are removed from the immediate recall testing analysis, KER subjects obtain a group mean of 48.21 (from 44.73 when the nonreturning subjects are included in the analysis), and the level of significance thereby increases from .0088 to .0004 (F = 8.77). The means for KE and FCC were 39.79 and 34.00, respectively, in this analysis. Using the Bonferroni procedure, three pairwise comparisons were conducted, now a statistically significant difference between KE and KER subjects appears when attrition subjects are removed from the immediate recall analysis (Table 4).

Table 4
All Pairwise Comparisons for Nonattrition Subjects Using the Bonferroni t in Immediate Recall

Parameter	Estimate	p	Standard Error of Estimate
KE vs. KER	-8.4226	0.0118[a]	3.2603
KE vs. FCC	5.7857	0.0837	3.2982
KER vs. FCC	14.2083	0.0001[a]	3.4189

[a] Bonferroni criteria < 0.0167

Table 5 lists the group means, F values, and p values when three additional analyses of variance were conducted within groups to determine if there were significant differences in the scores of attrition versus nonattrition subjects per group during immediate recall testing. No significant differences emerged within treatments for KE or FCC attrition versus nonattrition subjects. However, a significant difference for immediate recall testing between KER subjects who did not return for the delayed testing condition (attrition subjects) and those who did return (nonattrition subjects) indicates a significant difference in scores ($F = 6.57$, $p < .0148$). Attrition subjects scored an average of 10 points lower than nonattrition subjects within the KER group with means of 38.31 (attrition) and 48.21 (nonattrition). Such a significant difference between attrition and nonattrition subjects did not appear within the other two groups.

Table 5
Attrition Versus Nonattrition Subjects
In Immediate Recall Testing

Group	Attrition Mean	Nonattrition Mean	F value	*p*
KE	43.88	39.79	0.82	0.3707
KER	38.31	48.21	5.23	0.0148
FCC	37.62	34.00	0.50	0.4825

Delayed Recall

Hypothesis II

Hypothesis II stated 'there are no statistically significant differences in the recall scores of keyword encoding subjects (KE), keyword encoding plus retrieval orientation information subjects (KER), and free choice control subjects (FCC) in a delayed recall test of 1 week."

Seventy-five subjects returned for delayed recall testing. The means for KE, KER, and FCC groups were 21.96, 31.79, and 21.00, respectively ($F = 5.23$, $p < .0076$). This hypothesis was rejected. Using the Bonferroni procedure, three pairwise comparisons were conducted with the results reported in Table 6. There were no statistically significant differences in the recall scores between the KE and FCC groups. Only KER subjects showed significant differences from both KE and FCC subjects.

Table 6
All Pairwise Comparisons Using the
Bonferroni t in Delayed Recall

Parameter	Estimate	p	Standard Error of Estimate
KE vs. KER	-9.8273	0.0076[a]	3.5775
KE vs. FCC	0.9642	0.7097	3.6191
KER vs. FCC	10.7916	0.0053[a]	3.7527

[a] Bonferroni criteria < 0.0167

On KER subject was eliminated from test 2 (delayed recall) results because of directions inadvertently provided by the experimenter to 'complete the retest quickly." Because this subject arrived 10 minutes late, he was unable to complete the recall test under the same conditions as the other subjects. Therefore, his delayed recall score of 4 was eliminated from test 2 results, although there remained a statistically significant higher group score for KER subjects, when compared to KE and FCC subjects, with or without his second score.

Analysis of Free Choice Group Learning and Recall Strategies

Table 7 lists the methods that the free choice (control) group employed in learning and recalling all vocabulary words and definitions. The analysis helped to determine whether free choice controls employed keyword or keyword-like strategies and how frequently those methods were employed. Responses were classified according to a system previously established by Poythress et al. (1980). In that system, five categories of responses were established, as illustrated below, along with a "no response" or no category of response. The categories were:

> Rote: Strategies classified as rote involve repetition of the to-be-learned material. For example, the statement, 'I say the words over and over" would be classified as rote.

Physical: Strategies involve noting physical similarities and differences between words and parts of words or using only a portion of the stimulus. For example, "I use the first letters to make a word" and "they both start with the same letter 'm'" would be classified as physical.

Imagery: Strategies classified as imagery involve the use of mental imagery. For example, the statement, "I picture the words in my head" would be considered an imagery strategy.

Elaboration: Strategies under this classification involve ways to make the to-be-learned material more meaningful by such methods as relating it to previous knowledge, or experiences, or thinking about the logical relationships.

Grouping: Strategies classified in this category involve dividing the to-be-learned material into meaningful categories.

None: Sometimes respondents do not give enough information for the grader to classify a response, or they make irrelevant responses. In these cases, the response is classified as none. (Poythress et al., 1980)

Twenty-three control subjects participated in the delayed recall experiment. Since many of them indicated that they used more than one kind of strategy for learning and recalling all vocabulary words and definitions (see Appendix F), a point was tabulated in one of the six categories each time a control subject's response corresponded to a given category. Control subjects who did not respond to the questionnaire would have been tabulated only once, under the category of "none," or no response. However, all 23 subjects responded to the questionnaire; therefore, Table 7 reflects zero responses for the category of "none."

Table 7
General Learning Strategies Employed Overall by Free Choice Controls by Percentages (N = 23)

Strategy	Percentage
Elaboration	65.22
Physical	60.87
Imagery	21.74
Rote	21.74
Grouping	0
None	0

No points were tabulated under Poythress' category of "grouping" since the subjects were specifically told not to review words and were presented with only one word and definition at a time. Only one subject in the control group indicated that he did not follow directions as specified and that he did indeed recall, remember the previously presented words and definitions throughout the experimental session. An analysis of the responses indicated that a majority of control subjects used a combination of methods rather than one specific learning strategy.

All KE and KER subjects indicated that they used the keyword suggested visual images 80% of the time or more, which the experimenter determined as the acceptable usage level (80% accounts for 25 of the 31 words). Eighteen of the KE subjects and 20 of the KER subjects reported they used the keyword method 100% of the time.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to investigate the effects of retrieval information presented at the time of encoding in the learning of English vocabulary words. Using group administered procedures, 110 volunteer college students were randomly assigned to three groups: subjects who received instruction in the keyword method (KE), subjects who received a retrieval strategy in addition to keyword instruction (KER), and a control group left to their own strategies, or free choice controls (FCC). Allowing 45 seconds of study time per word, the subjects attempted to learn the definitions of 31 uncommon English vocabulary words. They were then tested on their recall both immediately and after one week.

The keyword method was taught to students in a relatively short period of time. All keyword subjects required no more than 15 minutes to read and comprehend information and three examples using the keyword method. No subject required further individualized instruction from the experimenter.

Three pilot studies were conducted in preparation for the actual experiment. The first determined that 60 seconds was too lengthy a time for learning single trial words and definitions. The second pilot study, using 30 seconds per word, was found to be too short. Consequently, the final pilot study, using 45 seconds per word and definition, was deemed satisfactory by subjects. Pilot subjects were not used in the actual experiment.

In the actual experiment it was determined by chi-square analysis that the distribution of subjects was equal across treatments on the subject variable of academic status. There were no significant statistical differences in subject distribution by grade level. Therefore, the distribution was within the acceptable sampling error for the subject variable of grade level, even though a disproportionate amount of freshman volunteered for this experiment (Appendix G).

The experimental hypothesis that there would be no significant differences in recall among the three treatment groups in a test of immediate recall was rejected. Despite the attainment of nonsignificant differences between KE and KER groups, there was a statistically significant difference between the KER and PCC subjects favoring the former group.

A second hypothesis, that in a delayed recall test of 1 week there would be no differences in the recall scores across the three groups, was also significant. Although there were no significant differences between KE and FCC groups, KER subjects differed significantly from both KE and FCC subjects, surpassing both in delayed recall scores.

The learning and recall strategies most often used by the free choice subjects were elaboration, in which the subject relates the new material to previous knowledge, experiences, or constructs logical relationships, and physical methods, which involved noting similarities or differences between words. However, rote repetition strategies and imagery were also used by some subjects. KE and KER subjects indicated they used the suggested keyword encoding images at least 80% of the time.

When a separate analysis was conducted on the 35 subjects who failed to return for delayed recall testing, deleting these subjects from the immediate recall testing results increased the level of significance and revealed a statistically significant difference between KE and KER subjects favoring the KER group. This difference does not appear when attrition subjects are included in the immediate recall analysis.

Overall, then, it was found that in a test of immediate recall, those subjects receiving retrieval strategy information (KER group) surpassed the scores of the controls. Furthermore, the KER subjects scored significantly higher than either the KE or control group subjects during a test of delayed recall 1 week later.

[illegible]

One of th[illegible] comol[illegible] a college student must face [illegible] definitions of literally hundreds of term[illegible] discipline students are exposed to an [illegible] amount of new terminology and must be able to re[illegible] new words and definitions. The task of a foreign [illegible]e student is also very tedious, and while it is repo[illegible] that most students need help in learning the 1,000 to [illegible] words that are presented in the beginning or intermediate foreign language course, foreign language textbooks (and for that matter, any introductory textbook that exposes students to hundreds of new words and their meanings) give little attention to the process of vocabulary acquisition. Traditionally these texts have concentrated only on "detailed phonological descriptions and extensive presentations of grammatical rules" (Keller, 1978, p. 6). Now, the keyword retrieval method, as described in the present study, may be helpful with language and vocabulary learners.

The keyword method is one of several learning strategies that can be implemented in the classroom. Teachers can use keyword retrieval strategies whenever they present information that falls within some of the lower levels of Gagne's taxonomy (1977), such as verbal chaining, and Bloom's (1956) taxonomy. The keyword retrieval method, as described here and indicated in Singer's (1977) study, can also help motivate students in learning foreign languages, vocabulary, and other paired associate learning tasks.

Pressley, Levin, Digdon, Bryant, McGivern, and Ray (1982) maintain that positive keyword results have not been obtained with sophisticated learners when adult subjects receive instruction by group administration. This study concurs for KE subjects using the traditional keyword method, but differs for KER subjects given that when mature learners are provided with appropriate information concerning keyword usage for recall, a significant difference between keyword retrieval subjects and controls emerges on both tests of immediate and delayed recall. In both ANOVA tests, significant differences emerged; both differences were attributed to the keyword retrieval method when compared with the free choice method. Thus based on these results, it is strongly suggested that retrieval orientation information be provided for keyword learners, to facilitate better understanding of this visual technique.

In addition, retrieval orientation information appeared to permit KER subjects access to the words and their definitions at the end of 1 week. As mentioned in Chapter I, Hall et al. (1981) noted limitations of the keyword method based on nonsignificant delayed recall testing results. While this was evidenced by KE and FCC subject results in the present study, this limitation did not appear with KER subjects

Other limitations. Some additional limitations of the applicability of the present study are that some learners are overly resistant to using new and unfamiliar learning strategies. Also, as noted by this experimenter during seminars that have been conducted in the area of memory improvement and study skills, some students report that they are unable to visualize and therefore are severely limited in their use of the keyword method.

It is interesting to note that more than half of all controls (60.87% of FCC group) indicated they had used a keyword-type strategy for assisting them in learning and recalling the vocabulary words and definitions (this indication was marked under the category of "physical"—see Table 7). Again, more than half of all controls also indicated they used an elaboration strategy (associating the word and its definition together). Why then did the control group not outperform the keyword retrieval group in either immediate or delayed recall tasks?

On the surface it would appear that imagery played an important role in helping to produce these results: only 22% of controls used any kind of imagery strategy along with their elaboration and keyword-type (physical) strategies. Yet, if imagery were the only variable responsible for the significant difference, there should also be a significant difference between the KE and FCC subjects (since KE subjects were also instructed to image). However, a statistically significant difference did not appear between the KE or FCC groups on either immediate or delayed recall.

The theory of retrieval failure may help explain these results. If the original information cannot be constructed at the time of recall, the information will not be retrieved. Forgetting thereby constitutes a "failure of storage retrieval, or [illegible] [illegible]dre, [illegible] p. [illegible]. In the present experiment, [illegible] retrieval failure as a reason for formulation of [illegible] information processing memory model was therefore [illegible] ([illegible] 1972) suggests that certain 'aspects of the original information serve as retrieval cues' (p. 5). In this study, those aspects consisted of experimenter selected keywords, along with connecting visual associations. At the time of retrieval, certain aspects of the original stimulus (i.e., the keyword) are perceived as part of the retrieval cue. In long term storage, this information is then addressed, and a search for the remainder of information pursues (i.e., the subject begins a mental search to reconstruct a response). Therefore, if no response is made by the subject, retrieval cues at the time of learning (encoding) may not have been sufficient.

It can therefore be suggested that the reason why KE and FCC subjects did not receive statistically superior scores, when compared to FER subjects on long term retention, is based on the same reason: neither group received, nor had available to them, sufficient retrieval orientation information. It appears that visual suggestions and keywords alone are not sufficient enough to produce a significant effect when subjects receive instruction through group administration. The student must fully understand the process of his technique. Individuals who are able to retrieve information in a more efficient manner should therefore obtain higher scores. Perhaps a difference in immediate recall scores between individually tested keyword and control subjects can be attributed to retrieval cues. Subjects individually tested may be more readily able to understand the concepts of keyword retrieval than subjects under group administration without the benefit of retrieval orientation information. When subjects are tested on a one-to-one basis they may be more inclined to be attentive to the procedures at hand. Group administered subjects, realizing they are mass participants in an experiment, rather than unique individuals, may not be as motivated to concentrate on keyword techniques. Therefore, the additional retrieval orientation information may help them to focus on the procedures and techniques. Retrieval alone does not totally explain the higher KER scores, since there was no statistically significant difference between the KER and KE subjects in the immediate recall test.

Since a significantly different group administered KER score was obtained when compared to ICC and KE subjects on delayed retention, perhaps future research should attempt to examine other variables that would produce a significant difference between KE and KER groups in immediate recall tasks. It may be that motivation is the vital component that separates these two groups in tests of immediate recall since a significant difference between KE and KER subjects did emerge when attrition subjects were removed from the time 1 testing

Recommendations

The expected differences between keyword retrieval subjects and control subjects emerged in both tests of immediate and delayed recall, while keyword [illegible] (KE) subjects obtained scores similar to those reported in other keyword group administered experiments (Pressley, Levin, & Delaney, 1982). The present study did not assess whether the higher KER score was due exclusively to the retrieval variable or whether other factors contributed to the significant results.

The present results also indicated that significant scores can be obtained using the keyword method in a group setting. More studies need to be conducted to determine if additional amounts of time provided to the keyword retrieval and control subjects would continue to produce significant group differences. Although the present study was experimenter-paced, 45 seconds seemed more reasonable than 10 seconds of study time per word, and better simulated students' natural study habits.

Future researchers may wish to investigate time variables, foreign vocabulary, other English vocabulary, and various age levels in intact classrooms, using the keyword retrieval method. The results based on the present study may be useful to classroom teachers who have sought an efficient method for teaching vocabulary (foreign and nonforeign) to students. The results of this study lend hope that retrieval-based keyword designs can be useful to the academic community and therefore the following research recommendations are suggested.

Recommendation 1

A comparison between keyword retrieval subjects, individually tested and group administered, would assess whether or not group administered keyword subjects would obtain a higher group mean. Pressley, Levin, Digdon, Bryant, McGivern, and Ray (1982) discovered that nonpaced individually tested keyword subjects obtained higher scores than paced keyword subjects, but that both groups consistently outperformed controls. However, if superior recall is the objective, then it may likewise appear, in a comparison between group and individually tested keyword retrieval subjects, that individually tested subjects outperform group administered KER subjects.

Recommendation 2

The factor of time in group administered procedures needs to be further investigated. Would the KER group continue to obtain a higher group score if all groups were given an unlimited amount of study time per word? Subjects could again be given one and only one vocabulary word and definition per page but be instructed to spend as much time as they wish on each word and definition. By providing only one word and definition per page, it would help to eliminate the effect of subjects attempting to use other mnemonic strategies in addition to the keyword method, such as clustering or initialing.

Recommendation 3

Although there appears to be no difference in scores between foreign and English vocabulary studies, a replication of the present study with foreign languages would either verify or refute this assumption.

Recommendation 4

A criticism of the keyword method is that it is useful only with words in which keywords are readily available (Pressley, Levin, & Delaney, 1982). Would retrieval orientation information also be useful with students when keywords are not readily found? Would such subjects need more practice with the keyword method before it could be effective for helping retrieve more complex information? Such long term studies would be useful for classroom applications.

Recommendation 5

A keyword-like technique is currently being used by this experimenter for teaching students how to remember information that appears in a given numerical order. For instance, in one example, students are exposed to the fifteen characteristics of self-actualized persons, as described by Maslow [illegible] Students [illegible] easily visualized [illegible] etc.) and to then visualize certain keywords from the body of the information. The pegword and keywords are then associated together in visual imagery. It has been discovered by this researcher that subjects using the combination pegword/keyword technique remember more information than subjects who are left to their own devices. A controlled, scientifically designed experiment could test the validity of this assumption.

Recommendation 6

Keyword and keyword-like techniques are currently being used by this experimenter for teaching students how to remember chapter outlines. These various mnemonic techniques, if supported by scientific findings, can prove to be vital information for classroom teachers. Mnemonic techniques represent cognitive theory applied in actual classroom settings. As noted by Jerome Bruner (1966), the "what" of learning has always been emphasized by classroom teachers—never the "hows." Hopefully, mnemonic strategies, when scientifically tested, will provide more information on how students can learn new information.

APPENDIX A
SAMPLES OF [illegible] PROTOCOLS FOR [illegible] [illegible] [illegible] [illegible] [illegible]

CATKIN--A CLUSTER OF FLOWERS

Keyword Cat

Connecting Thoughts 'See" a cat holding and sniffing a cluster of flowers

HINTS FOR REMEMBERING

1. Next time you see the word CATkin think of the keyword, cat.
2. Ask yourself Where did I "see" the cat?
3 Then you'll recall "seeing' a cat holding and sniffing a cluster of flowers.
4. With this picture in mind, it will be easy for you to respond, 'CATkin is a cluster of flowers "
5. Now close your eyes and review this mental picture

CATKIN--A CLUSTER OF FLOWERS

Keyword: Cat

Connecting Thoughts: See cat holding and sniffing a cluster of flowers

APPENDIX B
CHARGE BINS FOR ALL EXPERIMENTAL SAMPLES

[illegible] 7 Wood[illegible]
[illegible] Maguire Vi[illegible]
[illegible]e, Florida [illegible]
[illegible] 376-[illegible]
(Home) 376-60[illegible]

I am a gradua[illegible] do a [illegible] at the University of Florida. As part of my dissertation research, I need to gather information on learning, and [illegible] to administer a brief questionnaire (personal data sheet) to you in which you will list your age, student status, major, race, sex, citizenship, and a "code name," that will enable me to match your data.

The actual experiment will then take approximately thirty minutes to complete. A method for learning English vocabulary words and their definitions will be described to you on two sheets of instructions. You will be asked to conscientiously use this method to learn this material, and a recall test will follow immediately afterwards. The entire experiment, from beginning to end, should take no longer than one hour of your time. Three helpers and I will conduct the experiment, and I will be available to answer any questions you might have. You will not need to use any of your own paper, pens, or pencils during the experimental session; in fact, any writing is not permitted. However, you will need a pen or pencil to complete the recall test.

In this experiment, you may be learning a strategy for recalling technical words, vocabulary words, and foreign words that can help you in your future language studies. Your individual score will not be released to anyone and I plan to use group data results in my dissertation. No one will know your identity since you will be using a fictitious code name to identify yourself. There will be no monetary [illegible] no monetary compensation [illegible] riment however, you will be invited [illegible] n study skills and memory strategie. [illegible] 982, in this same auditorium [illegible] 45 p m (10th period) You have the r[illegible] ent at any time without prejudice

I HAVE READ AN[illegible] URE DESCRIBED ABOVE. I AGREE TO PARTICI[illegible] RE[illegible]IVED A COPY OF THIS DESCRIPTION

student s legal na[illegible] date

APPENDIX C
WRITTEN DIRECTIONS ON TEST PROTOCOLS FOR KE, KER, AND FCC GROUPS

Your task this [illegible] vocabulary words and their definitions u[illegible] known as the keyword method.

Recent scientific [illegible] shown that the keyword method can lead to better grades [illegible] less effort. Most memory improvement books explain how [illegible] improve his memory by using the keyword method. Let [illegible] how this method works.

Let's say you want to remember the definition for the word BASSOON, which means storm. Here's how you would remember this word and definition using the keyword memory method.

First you would find a keyword that will remind you of the word BASSOON. BASSOON reminds me of the word BASS. A part of the word BASSOON is BASS. So, my keyword is BASS. Next, I connect my thoughts by using my imagination. Visual imagery is extremely successful in helping people to remember things. So, in my mind, I can visualize thousands of BASS being tossed around in STORMy waters.

The keyword method is very easy to learn and use.

Let's take another example to make sure you understand the keyword method so that you can use this method successfully in the upcoming vocabulary task. Here's another word and definition.

BARBARIAN-- savage, cruel, uncivilized person

Using the keyword method, we could select the keyword, BAR. We could then imagine, in visual imagery, a savage, cruel-looking, uncivilized person sitting in a bar gulping beer. You might even imagine beer running down his chin and neck to help make your mind's picture even more vivid!

Now here a[illegible] keyword method.

1. Carefully rea[illegible]
2. Read over the keyword that [illegible]ed by the experimenter All keywords will consist of [illegible] can be easily visualized The keywords will either be a [illegible] larger word (just as BAR is a part of the word BARBARIAN), [illegible] keyword will rhyme with the word you are supposed to remember
3. Close your eyes and visualize the connecting image
4. USE ONLY THE IMAGERY SUGGESTIONS THAT I GIVE YOU TO TRY TO REMEMBER.
5. CONCENTRATE ON ONLY ONE WORD AT A TIME. DO NOT REVIEW PREVIOUS WORDS IN YOUR MIND.

THIRD ILLUSTRATION: NARD--an aromatic plant

To remember this word and definition, via the keyword method, I would first change the word NARD to LARD. Thus, LARD would serve as my keyword. Connecting Thought: I would then visualize an aromatic plant with chunks of LARD hanging from its leaves

The task I want you to do today concerns your verbal abilities through the application of the keyword method. You will be shown a word and its meaning You'll have 45 seconds to work on remembering each word and definition At the end of each 45 second period, the experimenter will tell you to move on to the next page Please do so

Afterwards, you will be tested on your recall of the definitions You will not be tested on the three examples that were provided here On the test, the words will be given You will be asked to give the definitions

If you are not su[illegible] this point please raise your hand an[illegible] and answer any of your questions. REMEMBER[illegible] for learning vocabulary words and their def[illegible] present experiment, only apply the keyword method [illegible] ONLY THE IMAGES SUGGESTED ON EACH LEARNING SHEET

[illegible]

Your [illegible] in [illegible] their definitions [illegible] the keyword method

Recent scientific [illegible] keyword method can lead to better grades [illegible] Most memory improvement books explain [illegible] memory by using the keyword method Let me [illegible] works

Let's say you want to remember [illegible] for the word BASSOON, which means storm Here's how you would [illegible] word and definition using the keyword memory method.

First you would find a keyword that [illegible] of the word BASSOON. BASSOON reminds me of the word BASS [illegible] of the word BASSOON is BASS So, my keyword is BASS [illegible] connect my thoughts by using my imagination Visual imagery [illegible] extremely successful in helping people to remember things [illegible] mind I can visualize thousands of BASS being tossed around in STORMy waters

HINTS FOR REMEMBERING

1 Next time I see the word BASSOON I will think of the keyword BASS

2. I then ask myself Where did I "see" the BASS? What were they doing?

3 Then I'll recall "seeing" BASS being tossed around in STORMy waters

4. The STORMy waters, that I picture in my mind, will trigger a response, "BASSOON means storm."

The keyword method is very easy to learn and use

Let's take another example to make sure you understand the keyword method so that you can use this method successfully in the upcoming vocabulary to [illegible]

BARBARIAN savage, [illegible]

Using the [illegible] could then imagine, [illegible] l-ized person sitting in [illegible] even imagine beer running down his chin [illegible]'s picture even more vivid!

HINTS FOR REMEMBERING

1 Then, when you see the word BARBARIAN again, your keyword, BAR would come to mind

2 You would ask yourself: Where did I "see" the BAR? Who was in the BAR? What was he doing?

3. Then you would recall "seeing" a savage, cruel, uncivilized person sitting in that BAR

4. With that picture in mind, you would have no problem responding, "A BARBARIAN is a savage, cruel, uncivilized person

Now here are the steps for successful use of the keyword method

1. Carefully read each word and its definition

2. Read over the keyword that has been selected by the experimenter All keywords will consist of nouns that can be easily visualized The keywords will either be a part of the larger word (just as BAR is a part of the word BARBARIAN OR the keyword will rhyme with the word you are supposed to remember.

3 Close your eyes and visualize the connecting image

4 USE ONLY THE IMAGERY SUGGESTIONS THAT I GIVE YOU TO TRY TO REMEMBER

5 CONCENTRATE ON ONLY ONE WORD AT A TIME DO NOT REVIEW PREVIOUS WORDS IN YOUR MIND.

THIRD [illegible]

To [illegible] method, I would fir[illegible] would serve as the keyword Co[illegible] aromatic [illegible] with chunks o[illegible]

HINTS FOR REM[illegible]

1. Next tim[illegible] of the [illegible] LARD
2. I would a[illegible] ARD?
3. Then I would [illegible] anging from the leaves of an aromatic [illegible]
4. With this pic[illegible] to respond [illegible] is an aromatic pla[illegible]

The task I wa[illegible] verbal abilities through the applicat[illegible] [illegible] be shown a word and its meaning You [illegible] n remembering each word and definition [illegible] period the experimenter will tell you [illegible] please do so

Afterwards, you w[illegible] r call of the definitions You will not be tested on th[illegible] examples that were provided here On the test, the words will b[illegible] en. You will be asked to give the definitions

If you are not sure how to use the keyword method at this point, please raise your hand and the experimenter will come over and answer any of your questions REMEMBER There are many techniques for learning vocabulary words and their definitions, BUT in the present experiment, only apply the keyword method TRY VISUALIZING ONLY THE IMAGES SUGGESTED ON EACH LEARNING SHEET

To r[illegible] their definit[illegible] thod

The fre[illegible] rning as [illegible] re learners [illegible] the [illegible] nique for learning and [illegible] words and definitions

For ins an[illegible] defi[illegible] tion of the word BASSOON, which means [illegible] According [illegible] y research that has been recently conducted [illegible] ents gener[illegible] about nine techniques that they use to learn [illegible] material [illegible] experiment, using the free choice method you will be [illegible] technique that you can think of in order to remember each [illegible] vocabulary word and its definition Then, the next time you [illegible] word like BASSOON, the technique you used to remember that word and [illegible] definition will come to your mind and you'll recall the meaning of the word

So, the free choice method is very easy to learn and use At the present moment, you can probably think of many different ways to go about learning and remembering vocabulary words You have probably used many of these methods in the past Today you will be able to use as many of these methods as possible on each and every vocabulary word with which you are presented

Let's take another example

BARBARIAN savage, cruel, uncivilized person

How would you go about remembering this word and its definition using the free choice method? The alternatives are open to you You may use any kind of idea or strategy that you wish--

[illegible] take just one more example

NARD an aromatic plant

How to go about remembering [illegible] word and its definition is your decision when you use [illegible].

In the upcoming exercise [illegible] use the free choice method that was described in [illegible]. You will find one word and its corresponding definition [illegible] and every page Work on one word and definition at a time until the experimenter tells you to move on DO NOT REVIEW WORDS CONCENTRATE ON ONLY ONE WORD AND DEFINITION AT A TIME

The task that I want you to do today concerns your verbal abilities through the use of the free choice method Within this area are tests of reading comprehension, verbal reasoning, and vocabulary knowledge In other words, it has to do with word power A list of words has been chosen You will be shown the word and its meaning and be given a chance to study these Try to do this in as an efficient manner as possible You will be given a test upon completion of the study period You'll have 45 seconds to work on remembering each and every word At the end of each 45 second period, the experimenter will tell you to move on to the next page Please do so

Afterwards, you will be tested on your recall of the definitions You will not be tested on the three examples that were provided here On the test, the words will be given You will be asked to give the definitions [illegible] Please make [illegible] and consult any of your questions. REMEMBER [illegible] techniques for learning vocabulary words and their definitions. [illegible] the present experiment, only apply the free choice [illegible] [illegible] atever you want to try to remember these words and [illegible] may not use pencil and paper.

APPENDIX I
THE 31 EXPERIMENTAL WORDS AND THEIR DEFINITIONS

Word	[illegible]
Antiar	[illegible]
Bolter	[illegible]
Bullace	[illegible]
Bustard	[illegible]
Casern	[illegible]
Catkin	[illegible]
Claymore	[illegible]
Cordite	[illegible]
Corniche	[illegible]
Cotter	[illegible]
Cowry	[illegible]
Dogger	[illegible]
Dottle	[illegible]
Fanfold	[illegible]
Flamen	[illegible]
Gaskin	[illegible]
Hamate	[illegible]
Hosel	[illegible]
Inkle	[illegible] trimming garments
Jarvey	[illegible]
Lapidist	[illegible] stones
Lawing	[illegible] a tavern
Lumper	[illegible] oads boats
Manchet	[illegible]

Word	[illegible]
Padle	[illegible]
Piggin	[illegible] wooden pail
Ramekin	[illegible] made of mixed cheese
Ratine	[illegible] fabric
Tarn	[illegible] mountain lake
Windling	[illegible] of straw

APPENDIX E
IMMEDIATE AND DELAYED RECALL TESTS FOR KE, KER, AND FCC GROUPS

[illegible]

Fill in th[illegible]
scoring, pl[illegible]
you saw dur[illegible]

1. PANFOLD ____

____

2. RAMEKIN ____

____

3. PADLE ____

____

4. LAPIDIST ____

____

5. HOSEL ____

____

6. GASKI[illegible] ____________________________________

____

7. BOLTER ____

____

8. GUNNEL ____

____

9. DOTTLE ____

____

10. CORDITE ____

____

11. RATINE ____

____

12. [illegible] ____

13. [illegible] ____

14. FILLET ____

15. MANC[illegible] ____

16. CATKIN ____

17. FLAMEN ____

18. CORNICHE ____

19. PIGGIN ____

20. COTTER ____

21. LUMPER ____

22. BUSTARD ____

23. HAMATE ____

24. WINDLING ____

25. TARN ____________________

____

26. ANTIAR ____________________

____

27. DOGGIE ____________________

____

28. LAWING ____________________

____

29. CLAMALL ____________________

____

30. INNE ____________________

____

31. COMP ____________________

____

APPENDIX [illegible]
LEARNING [illegible] QUESTIONNAIRE [illegible] CONTROLS

[illegible] ____________________

[illegible] ____________________

(OPTIONAL)

CIRCLE ONE:

DID YOU FOLLOW THE LEARNING INSTRUCTIONS?

1. 100% of the time

2. 80% of the time

3. 50% of the time

4. 40% of the time or less

IF YOU DID NOT FOLLOW THE KEYWORD VISUALIZATIONS ALL OF THE TIME, OR, IF YOU WERE IN THE FREE CHOICE GROUP, PLEASE DESCRIBE BELOW OTHER STRATEGIES YOU USED TO REMEMBER THE WORDS AND DEFINITIONS: (use back if necessary)

____

____

____

____

____

____

____

____

APPENDIX G

CHI-SQUARE ANALYSIS OF THE ACADEMIC STATUS OF KE, KER, AND FCC GROUPS

		Group Membership			
Academic [illegible]		[illegible]	KER	PCC	[illegible]
Freshmen	Frequency	[illegible]	13	4	24
	Percent	[illegible]	11.93	3.67	[illegible]
	Row Percent	29.17	54.17	16.67	
	Column Percent	18.92	36.11	11.11	
Sophomore	Frequency	12	11	10	33
	Percent	11.01	10.09	9.17	30.28
	Row Percent	36.36	33.33	30.30	
	Column Percent	32.43	30.56	27.78	
Junior	Frequency	14	11	17	42
	Percent	12.84	10.09	15.60	38.53
	Row Percent	33.33	26.19	40.48	
	Column Percent	37.84	30.56	47.22	
Senior	Frequency	4	1	5	10
	Percent	3.67	0.92	4.59	9.17
	Row Percent	40.00	10.00	50.00	
	Column Percent	10.81	2.78	13.89	
TOTAL		37	36	36	109*
Percent		33.94	33.03	33.03	100.00

*Note A nonstudent from KER was removed from this analysis.

Chi-square	9.376	df = 6, p = 0.1535
Phi	0.293	
Contingency Coef.	0.281	
Cramer's V	0.207	
Likelihood Ratio Chi-square	9.773	df = 6, p = 0.1345

APPENDIX B
SUBJECT PERSONAL DATA SHEET

1. YOUR CODE NAME ____________________

2. GROUP MEMBERSHIP (Circle one) 1 [illegible]

3. RACE ____________

4. CITIZENSHIP ____________________

5. AGE ____________

6. COLLEGE MAJOR ____________________

7. Circle one Freshman Sophomore Junior

   Senior Graduate Student

8. Circle one Male Female

9. Circle one From Human Development Class

   From Calculus Class

10. OVERALL G.P.A. ____________

APPENDIX [illegible]

EXPERIMENTAL [illegible]

1. Catkin: cluster of flowers
   Keyword: cat
   Connecting thoughts: 'See' a cat holding and sniffing a cluster of flowers

2. Hamate: a wrist bone
   Keyword: ham
   Connecting thoughts: Look at your wrist and 'see' yourself eating ham off your wrist bone.

3. Gaskin: part of the hind leg of a horse
   Keyword: gas
   Connecting thoughts: "See" yourself pouring gas on part of the hind leg of a horse.

4. Bullace: a purple plum
   Keyword: lace
   Connecting thoughts: 'See' a purple plum decorated with lace.

5. Panfold: a type of writing pad or paper
   Keyword: fan
   Connecting thoughts: 'See' a fan blowing around lot of folded writing pads and folded paper.

6. Hosel: part of a golf club
   Keyword: hose (hosiery)
   Connecting thoughts: "See" a pair of panty hose with a part of a golf club inside it.

7. Lawing: bill for food or drink at a tavern
   Keyword: law
   Connecting thoughts: 'See' a sign posted on the wall of a tavern that reads: "It's the law! You must pay your bill for food or drink."

8. Dogger: a fishing boat
   Keyword: dagger
   Connecting thoughts: "See" a dagger sticking through the middle of a fishing boat, splitting it in half.

9. Tarn: a small mountain lake
Keyword: tar
Connecting thoughts: 'See' a small mountain lake filled with tar instead of water

10. Lumper: person who loads or unloads boats
Keyword: lumber
Connecting thoughts: 'See' a person unloading lumber from a boat.

11. Cotter: a tenant farmer
Keyword: cotton
Connecting thoughts: 'See' a tenant farmer growing cotton.

12 Piggin: a small wooden pail
Keyword: pig
Connecting thoughts: 'See' one of the "three little pigs" carrying his little, small, wooden pail.

13. Jarvey: a carriage driver
Keyword: jar
Connecting thoughts: 'See' a miniature carriage and driver inside a glass jar

14. Casern: barracks for soldiers
Keyword: case
Connecting thoughts: 'See' soldiers living in cases rather than barracks.

15 Bolter: a machine for sifting
Keyword: bolt
Connecting thoughts: 'See' yourself sifting bolts through a sifting machine.

16. Ratine: a heavy fabric
Keyword: rat
Connecting thoughts: "See" a rat lavishly dressed in heavy fabric.

17. Gunnel: a salt water game fish
Keyword: gun
Connecting thoughts: "See" a gun firing salt at a game fish.

18 Inkle: A linen tape made for trimming garments
Keyword: Uncle
Connecting thoughts: 'See' your uncle trimming garments with linen tape

19. Dottle: half-burnt [illegible]
Keyword: (baby) bottle
Connecting thoughts: [illegible] baby bottle [illegible] half burnt [illegible]

20. Cordite: an explosive powder
Keyword: cord
Connecting thoughts: 'See' [illegible] explosive powder that sets off [illegible] of cords through the air.

21. Ramekin: a dish made of baked cheese
Keyword: lame kin
Connecting thoughts: 'See' your lame kin preparing a baked dish made of cheese.

22. Flamen: priest of ancient Rome
Keyword: flame
Connecting thoughts: 'See' a priest of ancient Rome carrying a flame.

23. Corniche: a road built on a cliff
Keyword: Cornish (hen)
Connecting thoughts: 'See' a Cornish hen climbing up a road built on a cliff.

24. Padle: a hoe
Keyword: saddle
Connecting thoughts: 'See' a saddle with a hoe for a stirrup

25. Bustard: a type of game bird
Keyword: custard
Connecting thoughts: 'See' game birds baked in custard

26. Windling: bundle of straw
Keyword: wind
Connecting thoughts: 'See' a bundle of straw being blown away by the wind.

27. Claymore: a type of sword
Keyword: clay
Connecting thoughts: 'See' a clay sword.

28. Antiar: a poison used on arrows by natives
Keyword: ant
Connecting thoughts: 'See' the natives killing ants with their poison arrows.

29. Lapadist: one who deals in precious stones
Keyword: Lip dentist
Connecting thoughts: 'See' a lip dentist placing precious diamonds and rubies in someone's lips.

30. Manchet   small loaf of white bread
    Keyword   man
    Connecting thought: There's a small man [illegible] a [illegible] loaf of white bread

31. Cowry: a glossy [illegible]
    Keyword   cow
    Connecting thought: There's a cow with glossy [illegible]
    [illegible]

[illegible]

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She has two gifted daughters, Melanie and Jennifer, and has authored a book on memory improvement.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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